E-P INC.

MODEL 350B
MODEL 351B

Autohet Frequency Counter

Operating & Service Manual

Serials Prefixed:

048–, 049–, 113–, 116–, & 130–

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CERTIFICATION

EIP INC. CERTIFIES THAT THIS INSTRUMENT WAS THOROUGHLY INSPECTED AND TESTED AND FOUND TO BE IN CONFORMANCE WITH ITS PUBLISHED SPECIFICATIONS WHEN IT WAS SHIPPED FROM THE FACTORY.

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SECTION I

GENERAL INFORMATION AND SPECIFICATIONS

1-1. DESCRIPTION

1-2. The EIP Models 350B and 351B Autohet Frequency Counters automatically measure the frequency of any CW signal from 20 Hz to 12.4 GHz and 20 Hz to 18 GHz respectively. In both models this frequency coverage is obtained in three bands; 20 Hz to 210 MHz, 210 MHz to 1.2 GHz, and 1.2 GHz to 12.4 GHz (350B) or 18.0 GHz (351B).

1-3. Measurements in Band I (20 Hz to 210 MHz) are made with a 210 MHz electronic counter. Band II and Band III (210 MHz to 1.2 GHz and 1.2 GHz to 12.4 GHz or 18 GHz), measurements are made by heterodyning the input frequency down into the range of the 210 MHz counter with an automatically selected harmonic of the internal 100 MHz comb generator. This 100 MHz comb generator is derived from the 5 MHz crystal oscillator in the counter. Thus, the stability and accuracy of the counter time base (<5 parts in 10^9/24 hours) are maintained over the entire frequency range.

1-4. The display on the 350B and 351B gives a direct readout of the measured frequency. In Bands II and III, this is accomplished by presetting the three most significant digits of the 11-digit counter to the harmonic number of the automatically selected comb line (harmonic), and then adding to it the heterodyned difference frequency.

> NOTE: The difference frequency is added since the comb line selected is always lower than the input frequency.

1-5. The frequency readout of the 350B and 351B is presented in a fixed format that is conveniently sectionalized in GHz, MHz, KHz, and Hz and gives 1 Hz resolution at a 1 Hz rate and 10 Hz resolution at a 10 Hz rate (even at 18 GHz).

1-6. For applications where less resolution is required, pushbutton display blanking is provided to simplify the readout.

1-7. To assure trouble-free performance, both the 350B and 351B are completely solid-state with the exception of the NIXIE display tubes. For ease of repair and maintenance, all circuitry has been placed on plug-in printed circuit cards with special test points provided to allow monitoring of critical circuit functions. In addition, all integrated circuits have been put on sockets.

1-8. INSTRUMENT IDENTIFICATION

1-9. Each Autohet Counter is identified by a two-section, eight digit serial number (XXX-XXXXX). The three-digit prefix designates the unit's configuration; the remaining digits are the unit's serial number.

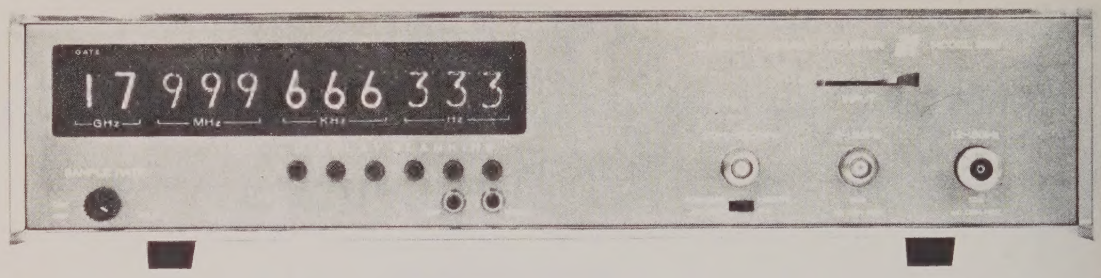
1-10. This manual applies to all Autohet Counters having the prefix (es) listed on the cover. Revisions required to adapt this manual to serial number prefixes not listed on the cover are contained in the insert entitled "Manual Revisions".

1-11. SPECIFICATIONS

1-12. Specifications for Autohet Frequency Counter, EIP Models 350B and 351B, are contained in Table 1-1.

NOTICE

"AUTOHET" is a registered trademark of EIP, Inc.
"NIXIE" is a registered trademark of Burroughs Corporation.



FREQUENCY RANGE: 20 Hz to 12.4 GHz (Model 350B).
20 Hz to 18.0 GHz (Model 351B).

ACCURACY: ±1 count ± time base stability in all bands.

RESOLUTION: 1 Hz.

READING RATE: 10 Hz resolution gives 5 readings/second maximum in Band I and 10 readings/second maximum in Bands II and III. 1 Hz resolution gives 1 reading/2 seconds maximum in Band I and 1 reading/second maximum in Bands II and III.

BAND I:

Frequency Coverage:	20 Hz to 20 MHz	1 MHz to 210 MHz
Minimum Sensitivity:	100 mV rms	−13 dBm (50mV rms)
Maximum Input:	120 V rms	+13 dBm (1.0 V rms)
Maximum Input Without Damage:	150 V rms	+30 dBm (8.0 V rms)
Input Impedance:	1 Megohm, 30 pf	50 ohms nominal

Coupling: AC
Connector Type BNC female

BAND II:

Frequency Coverage: 210 MHz to 1.2 GHz.
Minimum Sensitivity: 100 mV rms (−7 dBm).
Maximum Input: 1 V rms (+13 dBm).
Maximum Input Without Damage: 2.2 V rms (+20 dBm).
Input Impedance: 50 ohms nominal.
Coupling: AC
Connector: Type BNC female.

BAND III:

Frequency Coverage: 1.2 GHz to 12.4 GHz (Model 350B).
1.2 GHz to 18.0 GHz (Model 351B).
Minimum Sensitivity: 100 mV rms (−7 dBm) for frequencies between 1.2 GHz and 12.4 GHz.
160 mV rms (−3 dBm) for frequencies between 12.4 GHz and 18.0 GHz (351B only).
Maximum Input: 0.7 V rms (+10 dBm).
Maximum Input Without Damage: 2.2 V rms (+20 dBm).
Input Impedance: 50 ohms nominal.
Coupling: DC
Connector: Type N precision female.

TIME BASE:

Crystal Frequency: 5 MHz
Stability:
Aging Rate: < 5 parts in 10^9 per 24 hours after 72 hours warmup.
Short Term: < 1 part in 10^{10} rms (1 second averaging).
Temperature: < 6 parts in 10^8 maximum shift (10 to 50°C).
Line Voltage: ±10% change in line voltage produces frequency shift of < ±5 parts in 10^{10}.
Oven Control: Proportional (activated whenever unit is plugged into AC power source).
Output Frequency: 1 MHz, approximately 1 V peak to peak into 50 ohms.
External Time Base: Requires 1 MHz, 1 V peak to peak into 1 kohm.

DISPLAY: 11 digits sectionalized to read GHz, MHz, KHz, and Hz.

OPERATION: Completely automatic after setting Input Selector Switch.

ACQUISITION TIME: In Bands II & III comb line acquisition takes about 50 msec/GHz. Once locked to a comb line, readings can be taken at up to a 10 Hz rate.

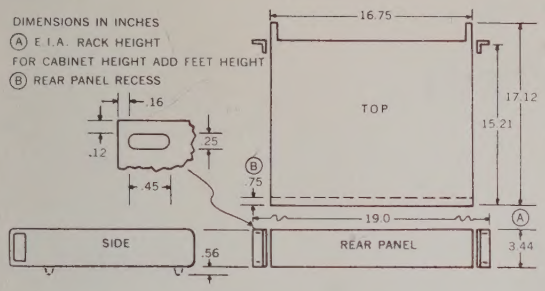
CONTROLS:

Sample Rate: Continuously variable from 10 readings per second (5 readings/second in Band I) to HOLD, independent of gate time.
Input Selector: Selects Band I, II, or III.
Mode Selector: Selects high or low impedance mode in Band I.
Display Blanking: Independent controls blank up to six least significant digits. 1 Hz blanking control selects 1 second (2 seconds in Band I) gate time. All other blanking controls select 0.1 second (0.2 seconds in Band I) gate time.
Reset: Resets display to zero and initiates a single read cycle.
Test: Counts and displays 1 MHz.

REMOTE RESET: Contact closure to ground at rear panel BNC connector initiates single read cycle.

OPERATING TEMPERATURE: 10°C to 50°C.
POWER: 115V or 230V ± 10%, 50 to 60 Hz, 90 watts.
WEIGHT:
Net: 30.0 lbs. (13.6 kg).
Shipping: 36.0 lbs. (16.5 kg).

DIMENSIONS:



ACCESSORIES FURNISHED: Detachable power cord, 8 ft. (241 cm) long with NEMA plug. Two each operating and service manuals.

ACCESSORY AVAILABLE: EIP Part Number 100460 rack mount kit.

OPTIONS

OPTION 03: High Stability Time Base.

Crystal Frequency: 5 MHz.

Stability:

Aging Rate: < 1 part in 10^9 per 24 hours after 72 hours warmup.

Short Term: < 1 part in 10^{10} rms (1 second averaging).

Temperature: < 3 parts in 10^8 maximum shift (10 to 50°C).

Line Voltage: $\pm 10\%$ change in line voltage produces frequency shift of $< \pm 2$ parts in 10^{10}.

Oven Control: Proportional (activated whenever unit is plugged into AC power source).

OPTION 05: Ultra High Stability Time Base.

Crystal Frequency: 5 MHz.

Stability:

Aging Rate: < 5 parts in 10^{10} per 24 hours after 72 hours warmup.

Short Term: < 1 part in 10^{10} rms (1 second averaging).

Temperature: < 3 parts in 10^8 maximum shift (10 to 50°C).

Line Voltage: $\pm 10\%$ change in line voltage produces frequency shift of $< \pm 2$ parts in 10^{10}.

Oven Control: Proportional (activated whenever unit is plugged into AC power source).

OPTION 04: Digital Output.

BCD Code: 8421 "1" state positive.

Format: 10 most significant data digits in parallel form.

"O" State Level: 0 to 0.4V, 5 mA current sink capability.

"I" State Level: +5V, 2 kohm source impedance.

Negative Reference: Ground.

Positive Reference: +5V, 22 ohm source impedance.

Print Command: +5V to 0V step, fall time < 1 microsec, 20 microsec. width, 2 kohm source impedance.

Hold Off Requirements:

Maximum: 50 volts.

Minimum: 2 volts.

Output Connector: Amphenol 57-40500 50-pin female. Mating connector, Amphenol 57-30500 50-pin, male.

OPTION 06: Programmable IF Offsets.

Mode of Operation: The readings of any frequency within the range of the counter are increased or decreased by the selected IF offset except no negative offsets are available for input frequencies below 210 MHz. If no offsets are selected, counter reads normally.

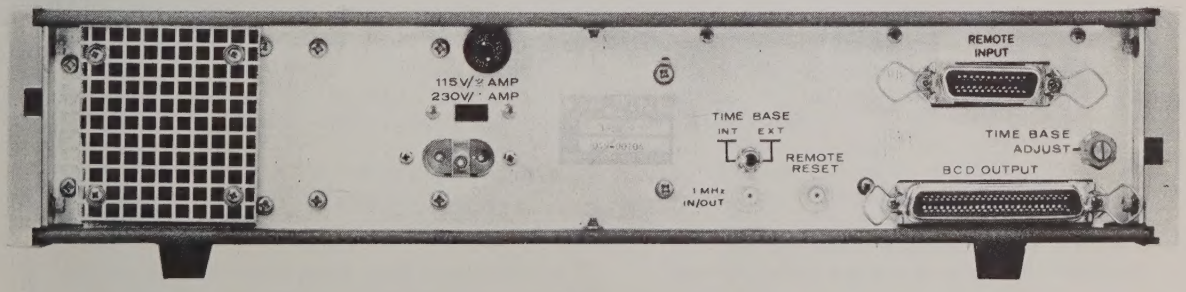
Offset Frequencies: + 21.4 MHz, − 21.4 MHz, +30 MHz, − 30 MHz, +60 MHz, − 60 MHz, +160 MHz, − 160 MHz.

Offset Selection: Ground contact closure (T^2L and DTL compatible) at rear panel programming connector in 4 line binary code selects desired IF offset.

Programming Connector: Amphenol 57-40240 24 pin, female.

Mating Connector Amphenol 57-30240 24 pin, male.

Accessory Available: EIP Model 1001A Remote Programmer provides proper ground contact closure programming to select desired IF offset. Includes 6 ft. interconnecting cable.



SECTION II

INSTALLATION

2-1. UNPACKING

2-2. The Models 350B and 351B arrive ready for operation. Before opening the package, carefully inspect the shipping carton for any evidence of damage. If the shipping carton is damaged, ask that the carrier's agent be present when the instrument is unpacked.

2-3. Remove the packing carton and supports, being careful not to scar or damage the unit. Make a complete visual inspection of the equipment, checking for damage or missing components. Check that all switches and controls operate mechanically. Report any damage immediately to EIP, Inc.

2-4. INSTALLATION

2-5. There are no special installation instructions for the 350B and 351B. They are both self-contained bench instruments which only require connection to standard 115 or 230 Vac line power for operation. A slide switch on the rear panel is moved to the position corresponding to the line voltage available and the appropriate fuse is installed. Unless otherwise noted, these units are shipped from the factory set for 115 Vac operation.

2-6. Rack mount hardware is available for these instruments (EIP Part Number 100460 - Rack Mount Kit). To install it, remove the existing side covers. Attach the rack mounting ears to the two holes at the front of the side frame with the screws supplied.

2-7. INCOMING OPERATIONAL CHECK

2-8. The following procedure outlines an operational check of the instrument which may be conducted without special tools, signal generators or special test equipment. The internal TIME BASE CLOCK is used as the input signal; therefore, it does not test the operation of the heterodyne converters (.2 to 1.2 GHz or 1.2 to 12.4 GHz or 18.0 GHz). However, since most of the circuits are interrelated, this test provides a good confidence check.

a. See that the SAMPLE RATE switch is turned fully counter-clockwise (past the detent) to the OFF position.

b. See that the rear panel 115/230 volt line switch is in the required position. Make sure that the appropriate fuse is installed.

c. Connect the instrument power cord to the proper source with the ground terminal connected.

d. Turn the SAMPLE RATE switch clockwise past the detent. Note that the display turns on and the fan is operating.

e. Put the rear panel TIME BASE EXT/INT switch to INT.

f. Put the BAND switch fully right to the 1.2 GHz to 12.4 (or 18) GHz (Band III) position.

g. Operate each of the DISPLAY BLANKING switches from left to right until all the digits on the 11-digit display are turned on.

h. Depress the TEST switch on the front panel. Note that the display indicates: 00,001,000,000.

i. Blank the 1 Hz digit by operating the DISPLAY BLANKING switch.

j. Depress the TEST button again. The display should still indicate 1 MHz, but with the final 0 blanked. Note a decrease in gate time evidenced by shorter on-time of gate light.

k. Test each DISPLAY BLANKING switch in turn. Each switch blanks the digit immediately above it, as well as all the digits to the right.

l. Unblank all the display digits.

m. Put the BAND switch in the center to the 210 MHz to 1.2 GHz (Band II) position. The 10 GHz decade should be blanked.

n. Put the BAND switch fully left to the 20 Hz to 210 MHz (Band I) position, and the BAND 1 MODE switch in the 50 ohm position. Both the 10 GHz and the 1 GHz decades should be blanked.

o. Put the BAND 1 MODE switch in the 1 Ω , 30 pf position. The 10 GHz, 1 GHz, and 100 MHz decades should all be blanked.

p. With no input signal, the display should read all zeros in all three positions of the BAND switch.

q. The instrument confidence check is completed and any CW signals can now be counted as required.

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. The operation of the instrument is completely automatic after selecting the appropriate operating band. Controls and indicators have been kept to a minimum to ensure simple error free performance.

3-3. CONTROLS, INDICATORS AND CONNECTORS

3-4. Front panel controls, indicators and connectors for the EIP Models 350B and 351B are shown in Figure 3-1 and described in Table 3-1. Rear panel controls and connectors are shown in Figure 3-2 and described in Table 3-2.

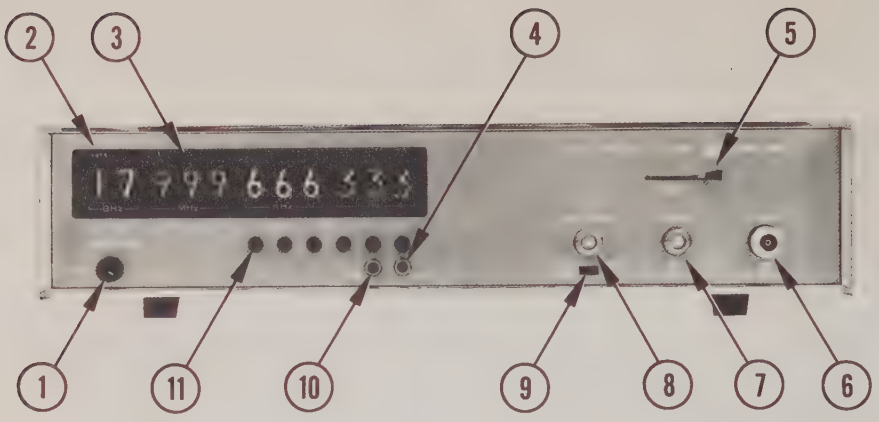


FIGURE 3-1. FRONT PANEL CONTROLS, INDICATORS AND CONNECTORS

TABLE 3-1. FRONT PANEL CONTROLS, INDICATORS AND CONNECTORS

ITEM NO.	ITEM	FUNCTION
1	SAMPLE RATE Control ON/OFF Switch HOLD Switch	This control has a dual function: turned fully counter-clockwise, the power to the unit is switched OFF (the oven power remains connected to the AC line); beyond the first detent, this control adjusts the sample rate from about 10 Hz to HOLD (fully clockwise).
2	GATE Indicator	The GATE light provides a visual indication when the counter has gated on.
3	Visual Display	The 11-digit NIXIE display provides a direct numerical readout of the input frequency. The display is conveniently sectionalized into GHz, MHz, KHz, and Hz.
4	RESET Pushbutton	The manual RESET pushbutton overrides all controls, resets the counter and the Autohet converters, and initiates a new reading.
5	BAND SELECT (INPUT) Switch	The BAND SELECT (INPUT) switch selects the operating frequency range of the Autohet counter. Band I - Placing the BAND SELECT switch in the fully left position allows measurements from 20 Hz to 210 MHz in two ranges. One range covers 20 Hz to 20 MHz with 100 mV sensitivity. The other range covers 1 MHz to 210 MHz with -13 dBm (50 mV) sensitivity. The position of the Band I MODE switch determines which Band I frequency range is selected. In the 20 Hz to 20 MHz range, the 10 GHz, 1 GHz, and 100 MHz decades are blanked. In the 1 MHz to 210 MHz range, 10 GHz and 1 GHz decades are blanked. Band II - Placing the BAND SELECT switch in the center position allows measurements from 210 MHz to 1.2 GHz with -7 dBm (100 mV) sensitivity. In this position the 10 GHz decade is automatically blanked. Band III - Placing the BAND SELECT switch in the fully right position allows measurements from 1.2 GHz to 12.4 GHz (350B), or 18 GHz (351B) with -7 dBm (100 mV) sensitivity to 12.4 GHz, and -3 dBm (160 mV) sensitivity from 12.4 GHz to 18 GHz.

TABLE 3-1. FRONT PANEL CONTROLS, INDICATORS AND CONNECTORS (Continued)

ITEM NO.	ITEM	FUNCTION
6	1.2 to 12.4 GHz (or) 1.2 to 18.0 GHz Band III Input Connector	This precision type N connector input allows frequency measurements from 1.2 GHz to 12.4 GHz or 18.0 GHz. (Most units cover from about 1.1 GHz to 12.420 or 18.020 GHz. If a measurement is made, the signal level is sufficient for specified accuracy.)
7	0.2 to 1.2 GHz Band II Input Connector	This BNC connector input allows frequency measurements from 210 MHz to 1.2 GHz.
8	20 Hz to 210 MHz Band I Input Connector	This BNC connector input allows frequency measurements from 20 Hz to 210 MHz.
9	BAND I MODE Switch	The position of this slide switch determines which frequency range in Band I is selected; either 20 Hz to 20 MHz with 100 mV sensitivity and 1 megohm input impedance, or 1 MHz to 210 MHz with -13 dBm (50 mV) sensitivity and 50 ohm input impedance.
10	TEST Pushbutton	Depressing the momentary TEST switch places the instrument in a self-test mode. It applies a 1 MHz signal derived from the 5 MHz time base oscillator to the 210 MHz counter circuits of the Autohet counter. (The proper display reading in the TEST mode is 1 MHz.)
11	DISPLAY BLANKING	Six independent switches allow blanking control of the visual display. Each switch is engaged or released by depressing the appropriate button. The switches blank the digits immediately above and all digits to the right. In addition to blanking the 1 Hz digit, the right-most switch changes the counter gate time from 2.0 seconds to 0.2 second in Band I and from 1.0 second to 0.1 second in Bands II and III.

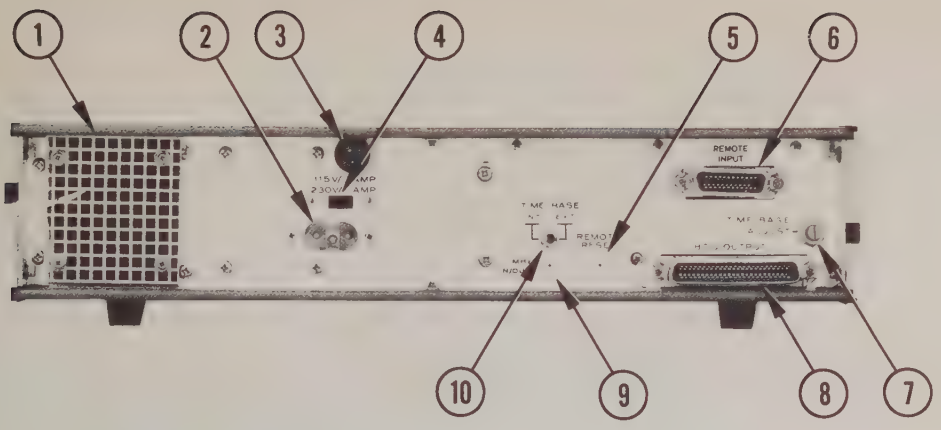


FIGURE 3-2. REAR PANEL CONTROLS, INDICATORS AND CONNECTORS

TABLE 3-2. REAR PANEL CONTROLS, INDICATORS AND CONNECTORS

ITEM NO.	ITEM	FUNCTION
1	Cooling Fan Air Passage Grill	Fan provides cooling air to internal components. Do not allow anything to block grill or restrict flow of air.
2	AC Power Connector	This connector accepts a power cable with a NEMA plug.
3	Fuse Holder	Fuse provides overload protection. For 115 Vac: Use 1 A - Quick Acting Fuse. For 230 Vac: Use 0.5 A - Quick Acting Fuse.
4	115/230 Switch	This slide switch selects the AC voltage level. All units are normally shipped in the 115 Vac position. Be certain the line fuse has the proper rating.
5	REMOTE RESET Connector	This BNC connector is for remote reset input. Grounding the input triggers a single reading.
6	REMOTE INPUT (IF OFFSET) Connector	Option 06. See description in Appendix C.
7	TIME BASE ADJUST	This screwdriver adjustment allows tuning of the internal 5 MHz oscillator during calibration.
8	BCD OUTPUT Connector	Option 04. See description in Appendix B.
9	1 MHz IN/OUT Connector	This BNC connector allows monitoring of the internal oscillator, or injection of an external 1 MHz reference signal.
10	TIME BASE INT/EXT Switch	This switch allows use of the internal time base oscillator, or use of an external 1 MHz reference oscillator.

SECTION IV

THEORY OF OPERATION

4-1. GENERAL

4-2. The Models 350B and 351B automatically measure the frequency of any CW signal from 20 Hz to 12.4 GHz and 20 Hz to 18 GHz respectively. In both models this frequency coverage is obtained in three bands: 20 Hz to 210 MHz, 210 MHz to 1.2 GHz, and 1.2 GHz to 12.4 GHz or 18 GHz.

4-3. Measurements in the Band I (20 Hz to 210 MHz) are made with a 210 MHz electronic counter. In Band II and Band III (210 MHz to 1.2 GHz and 1.2 GHz to 12.4 GHz or 18 GHz), measurements are made by heterodyning the input frequency down into the range of the 210 MHz counter with an automatically selected harmonic of the internal 100 MHz comb generator. This 100 MHz comb generator is derived from the 5 MHz crystal oscillator of the counter. Thus, the stability and accuracy of the time base are maintained over the entire frequency range.

4-4. Figure 4.1 shows a block diagram of the Autohet counter. Functionally, both Model 350B and Model 351B are identical, differing primarily in component selection and internal design.

4-5. The operation of the Model 350B and 351B is best described by separating the Autohet counter into two discrete functions: the 210 MHz digital counter, and the Autohet converters. These two functions are interconnected in only two significant areas: (1) presetting the counter to the appropriate harmonic number and (2) coupling the heterodyned difference frequency from the converters into the counter.

4-6. 20 Hz to 210 MHz COUNTER

4-7. This counter is common to all bands of the instrument and drives the 11-digit display. The display provides a stored readout which is updated once per measurement by a STORE command pulse. Display time, independent of gate time, is variable from 0.02 seconds to about 3 seconds, with a switched infinite HOLD position. Reset is automatic and produced by the trailing edge of the display time signal. In the infinite display setting, automatic reset is not produced and the instrument requires a manually generated reset trigger. This can be produced by either the front panel RESET switch or remotely by means of the rear panel REMOTE RESET connector. Display blanking in six decade steps allows the operator a choice of resolution from 1 Hz (display blanking off) to 1 MHz. The direct counter consists of: the input circuits, the time base and control circuits, and the count chain circuits.

4-8. The input circuits consist of two amplifiers. One covers the frequency range from 20 Hz to 20 MHz with a dynamic range of 100 mV rms to 120 V rms. The other covers the frequency range from 1 MHz to 210 MHz with a dynamic range of 50 mV rms to 0.7 V rms. The input signal is coupled directly into the counter through an input relay. This relay provides signal isolation when the counter is switched into the higher ranges.

4-9. The time base and control circuits develop the time base GATE, the STORE command, the PRINT command, the display time, the RESET and the PRESET signals. Reset is normally automatic with a provision for remote activation via the rear panel BNC connector, or for manual activation by the front panel mounted RESET switch. Reset interrupts the measurement cycle and initiates a new cycle.

4-10. The count chain circuits count the input signal, store it, and convert it to decimal form for display on the visual display indicators. Parallel BCD information for the ten most significant digits is also available from the count chain providing a low level digital drive for remote systems (Option 04).

4-11. The input signal is gated into the count chain circuits by the time base gate. The internal reference oscillator provides clock signals to the time base counter which develops the gate start and stop signals. At the start time, the count chain is allowed to accumulate inputs. At the end of the selected gate time, the stop signal is produced and the gate closed. At the stop time, the accumulated count is transferred to the storage register by the STORE command. The binary weights stored in the storage registers are coupled to the decoding matrix and converted to decimal information to drive the visual display indicators. Unless placed in the infinite display setting, a new measurement cycle is automatically initiated by the RESET signal. Automatic reset is activated by the display timer circuits.

4-12. AUTOHET CONVERTERS

4-13. The Autohet Converter contains eleven basic functional sections. Five of these sections are common to both the Band II and Band III converters. The common sections are: 20 MHz Phase Locked Oscillator, X5 Frequency Multiplier, Dual Power Amplifier, Signal Acquisition Section, and Sweep Driver Section. In addition, the Band II converter contains a YIG-tuned Comb Generator and a Mixer/Video Amplifier, while the Band III converter contains a Mixer, Video Amplifier, YIG-tuned Comb Generator, and a Power Control Circuit. The Signal Acquisition Section, Sweep Driver Section, and Power Control Circuit are all contained in the Converter Control Unit.

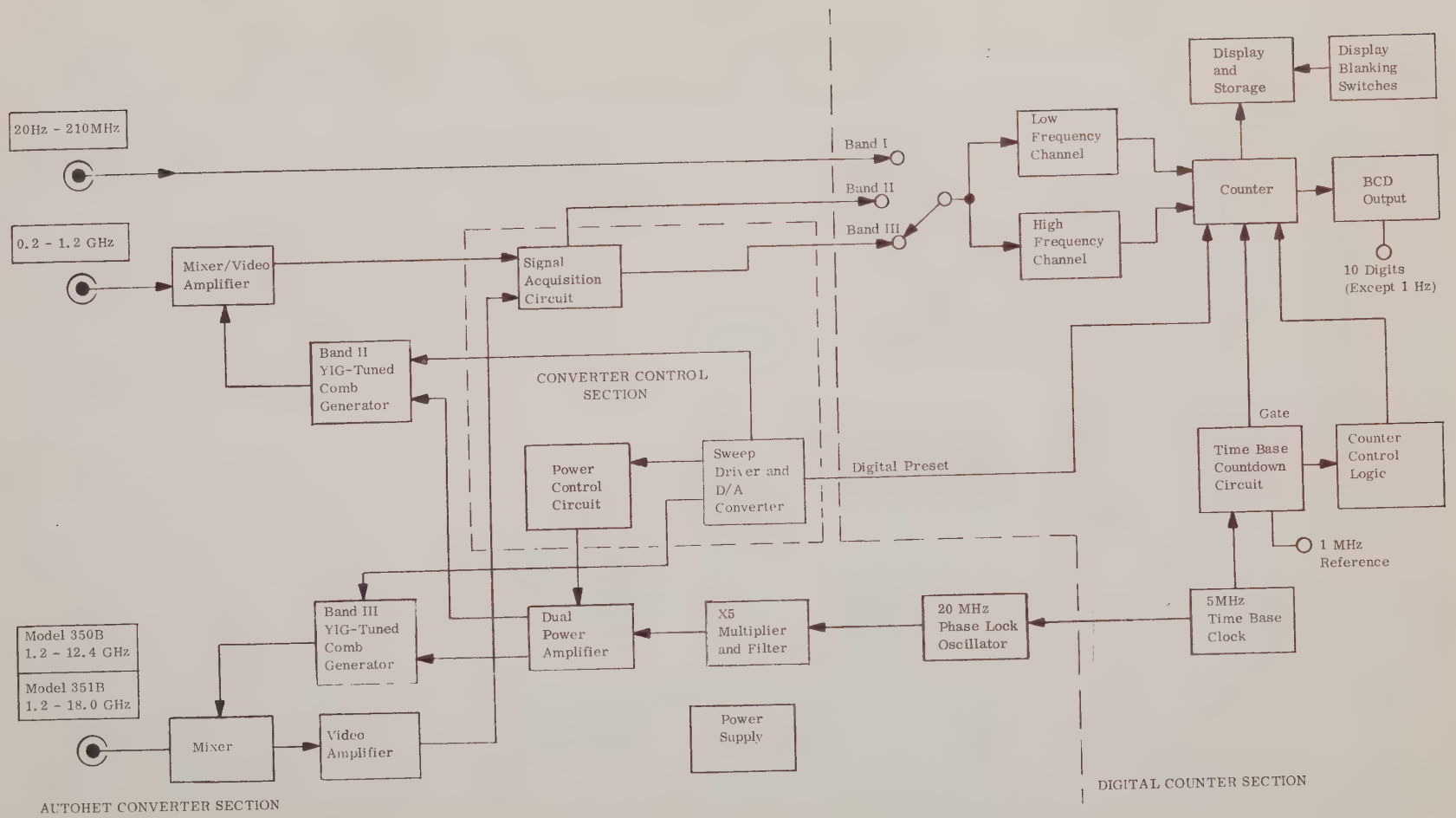


FIGURE 4-1 AUTOHET COUNTER - FUNCTIONAL BLOCK DIAGRAM

4-14. In normal operation, an input signal in either of the two Autohet converters is detected in the Signal Acquisition Section and initiates a scan of the appropriate YIG-tuned Comb Generator through all of the comb lines. These comb lines are derived from the 1 MHz time base in the following manner: A 20 MHz oscillator is phase-locked to the time base using a digital phase-lock technique; the oscillator output is then frequency multiplied in the X5 frequency multiplier to 100 MHz and amplified in the Dual Power Amplifier. This amplifier has two outputs: A low power output (about 50 milliwatts) that is used to drive the 0.2 to 1.2 GHz comb generator, and a high power output (about 570 milliwatts) that is used to drive the 1.2 to 12.4 GHz or the 1.2 to 18.0 GHz comb generator.

4-15. The YIG filter is scanned over the output of the comb generator by a digital-to-analog converter in the Sweep Driver Section, at a rate of approximately 25 msec/GHz in Band III, and 50 msec/GHz in Band II.

4-16. The resulting output of the YIG, consisting of sequentially selected 100 MHz comb lines, is coupled into an input mixer, where it is heterodyned with the input signal. The difference frequency produced in the mixing process is amplified in a wide-band video amplifier and detected in the Signal Acquisition Section. When the difference frequency falls within the range of 8 MHz to 120 MHz, the Signal Acquisition Section initiates a STOP command, which inhibits the D/A clock, stops the sweep and generates a "LOCK" signal. (The first output detected during the scan always corresponds to a comb line below the input frequency.) The "LOCK" signal, in turn, starts a normal count cycle of the 210 MHz counter which measures the IF difference frequency at the output of the video amplifier. During this normal count cycle, the digital number stored in the D/A converter is entered into the three most significant digits of the counter display. The IF difference frequency counted during this count cycle is then added to the preset display forming a complete readout of the unknown input frequency. For example, if the input frequency is 15,051,200 GHz, the "1-5-0" digits are preset into the counter and the .051200 GHz difference frequency is counted directly. If the signal is removed or tuned outside of the 8 MHz to 120 MHz window, the D/A driver is reset and the YIG filter sweep is initiated again until the next intercept. The sweep search time is about 25 μsec/GHz; however, once lock is achieved, readings are made continuously at a rate of up to 10 readings per second.

4-17 DIGITAL COUNTER OPERATION

4-18. Figure 4-2 is a simplified block diagram of the digital counter. The functions shown are contained on three printed circuit boards except for the 5 MHz time base clock (A004) which is a separate, sealed unit. The Control Logic Board (A002) contains the time base countdown and the control circuits. The amplifiers, threshold circuits, and first decade of the counting circuits are all contained on the High Frequency Board (A001). The Display Board (A003) includes the remaining counting circuits, the information storage circuits and the 11-digit NIXIE display.

4-19. 5 MHz TIME BASE CLOCK (A004)

4-20. The Time Base Clock (A004) is the basic reference against which all measurements are made. The clock consists of: a precision, third overtone, 5 MHz crystal, an oscillator/buffer amplifier circuit, and a voltage regulator circuit sealed in a proportional oven. A varactor diode in the oscillator circuit biased by R1 (Time Base Adjust) on the rear panel of the counter, provides frequency adjustment of the clock. Power for the oscillator and oven is obtained from the +14 volt supply, and is on whenever the instrument is connected to AC power. The clock output is a T^2L compatible square wave gated by application of the +5 volt supply. Thus, there is no output present when the instrument is turned off.

4-21. CONTROL LOGIC BOARD (A002)

4-22. Control Logic Board A004 (See Figures 9-4 and 9-5) provides all necessary commands for proper counting of an input signal. The inputs to this board are the front and rear panel control settings, the LOCK command from the Converter Control Board (A101), and the 5 MHz Time Base Clock (A004) signal. From these inputs, the Control Logic Board performs the following functions:

a. Enables the appropriate amplifier on the High Frequency Board (A001).

b. Generates all the functions of the timing cycle. (See Figure 4-3 for a typical timing cycle.)

c. Provides RESET commands under any of the following conditions:

(1) Front panel RESET button depressed.

(2) Rear panel REMOTE RESET grounded.

(3) Loss of LOCK command.

(4) Application of RESET command from Converter Control Board (A101).

4-23. The Band Select function is accomplished by applying +12 volts to the appropriate INPUT (Band I - pin V, Band II - pin 19, Band III - pin 14). The Band I Mode switch grounds pin 13 to select the high impedance mode in Band I. The TEST button overrides all Band Select settings by grounding pin 12. In addition to selecting the various bands, the Band Select settings combine logically to produce the required levels for the INHIBIT 1, 2, and 3 commands, and for energizing relays K1 and K2. Table 4-1 shows the commands produced by the various switch settings. These commands program the High Frequency Board (A001). In addition, Inhibit 3 is used to inhibit the LOCK command and the 3MSD (three most significant digits) PRESET command on the Converter Control Board (A101) during Band I operation.

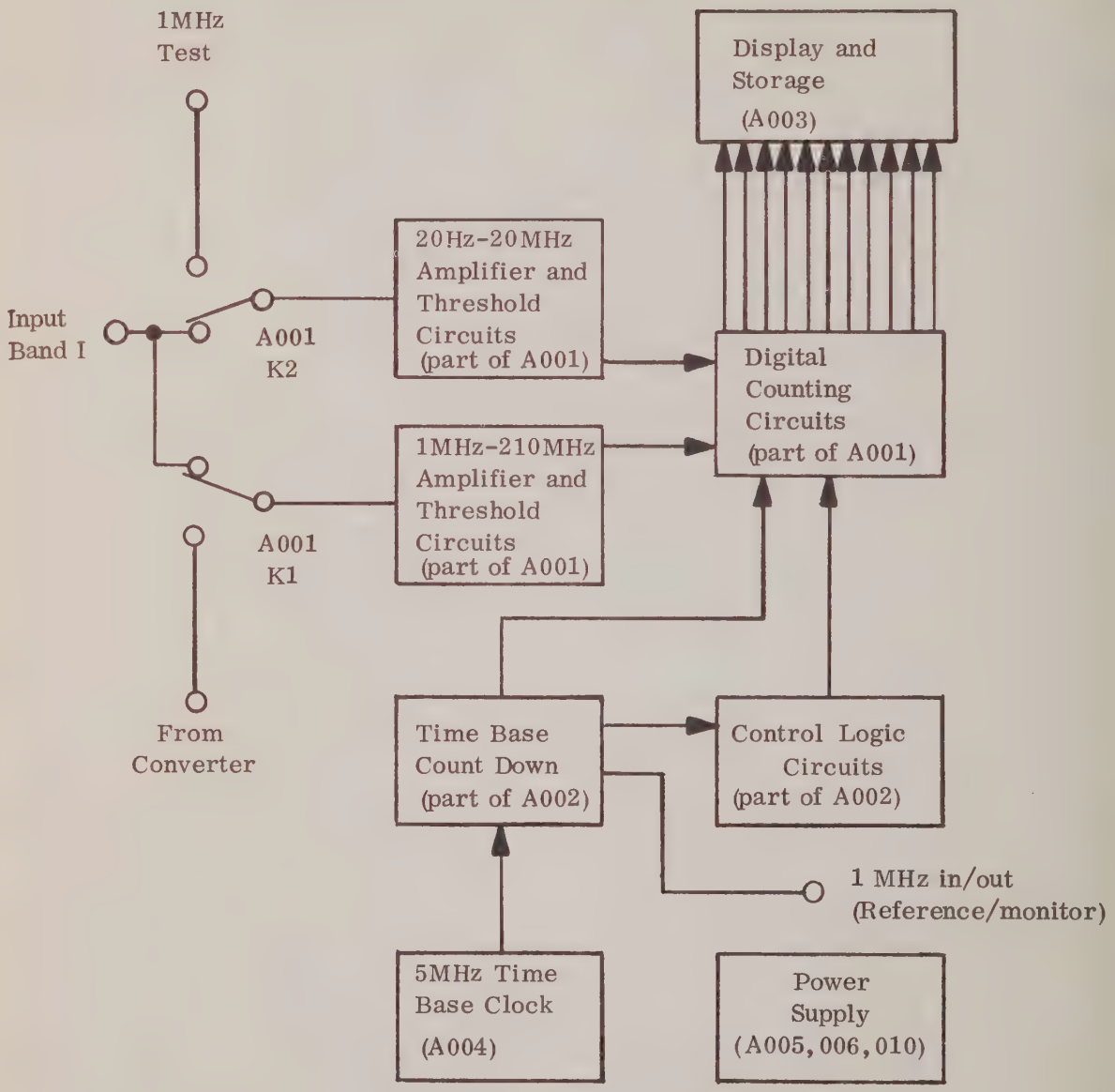


FIGURE 4-2
BLOCK DIAGRAM
DIGITAL COUNTER

4-24. The counting process begins by dividing down the signal from the 5 MHz Time Base Clock to 1 MHz (IC1, 2 and 3). The 1 MHz signal appearing at pin 7 is jumpered to pin F and drives emitter follower transistor Q1. The emitter follower output (pin 6) is connected to the rear panel time base (INT/EXT) switch. In the INT (internal) position, the signal is fed back to pin 5 where it drives a threshold circuit (IC7). The output of the threshold circuit is inverted (part of IC1) and is brought out at pin 4 as the reference clock signal for the Phase Locked Oscillator (A132). The signal also passes through two enabled gates and is present at the input of IC16 (pin 3). This gate is enabled by the presence of a LOCK command (Bands II and III) or INHIBIT 3 command (Band I) and the output drives a two decade countdown chain (IC18 and IC19). The BCD outputs from counter IC19 drive a BCD to Decimal converter (IC32) which functions as a sequence generator to implement the timing cycle shown in Figure 4-3. Since IC19 is being driven at a 100 KHz rate, its BCD output increases by 1 every 10 microseconds, thus generating sequential 10 microsecond pulses at each output of IC32.

4-25. The first pulse generates the COUNTER RESET command which resets the Display Board (A003) and high frequency decade counters to "0" on the High Frequency Board (A001). The 3MSD PRESET Command then allows the YIG-tuned Comb Generator harmonic number information from the Converter Control Board (A101) to be preset into three most significant digits of the Display Board (A003). This command is inhibited in Band I by INHIBIT 3. The OFFSET ADD GATE command allows for programming of an IF offset frequency on instruments with Option 06. See Appendix C for a description of this option.

4-26. The COUNTDOWN PRESET command presets a countdown chain consisting of six decade counters (IC9 through IC14) and a flip flop (IC15). The next command, COUNTDOWN CHAIN ENABLE, then allows the 1 MHz time base signal to be counted in the countdown chain. Four outputs from the countdown chain are available (100 msec, 200 msec, 1 sec, and 2 sec) to provide counter gate timing. The appropriate gate time (See Table 4-1) is applied to the eight input NAND gate (IC34). Gate time selection is determined by the setting of the Band Select switch and the Gate Expand switch (1 Hz digit blanking switch). The output of IC34 then drives a flip flop (part of IC15) which provides the GATE command (IC15, pin 5) to the High Frequency Board (A001). The inverted GATE output (IC15, pin 6) stops the sequence generator during the gate time by holding the output of IC16, pin 6 high. At the end of the GATE time, the sequence generator is allowed to continue counting.

4-27. The next pulse after the GATE time is the MEMORY STROBE command. This transfers the accumulated counts from the High Frequency Board (A001) and the Display Board (A003) to the display. A 20 microsecond PRINT command is generated by combining the next two 10 microsecond pulses. This command is required when a digital printer is used in conjunction with Option 04. See Appendix B for a description of this option.

4-28. The final pulse in the sequence, the SAMPLE RATE HOLDOFF, activates the one shot (IC4). This circuit stops the sequence for a time determined by C42, R73 and the setting of the front panel SAMPLE RATE Control.

TABLE 4-1. CONTROL LOGIC STATES

Band Select Setting	Relay A001K1	Relay A001K2	Inhibit 1	Inhibit 2	Inhibit 3	BLANKING Switch Position Any Off	BLANKING Switch Position All On
I (20 Hz to 20 MHz)	X	E	1	0	0	200 ms	2 sec
I (1 to 210 MHz)	E	X	0	1	0	200 ms	2 sec
II (210 MHz to 1.2 GHz)	X	X	0	0	1	100 ms	1 sec
III (1.2 to 12.4/18 GHz)	X	X	0	0	1	100 ms	1 sec
Test	X	X	1	0	0	200 ms	2 sec

X = Relay de-energized E = Relay energized

Any Off = Any DISPLAY BLANKING Switch in display OFF position

All On = All DISPLAY BLANKING Switches in display ON position

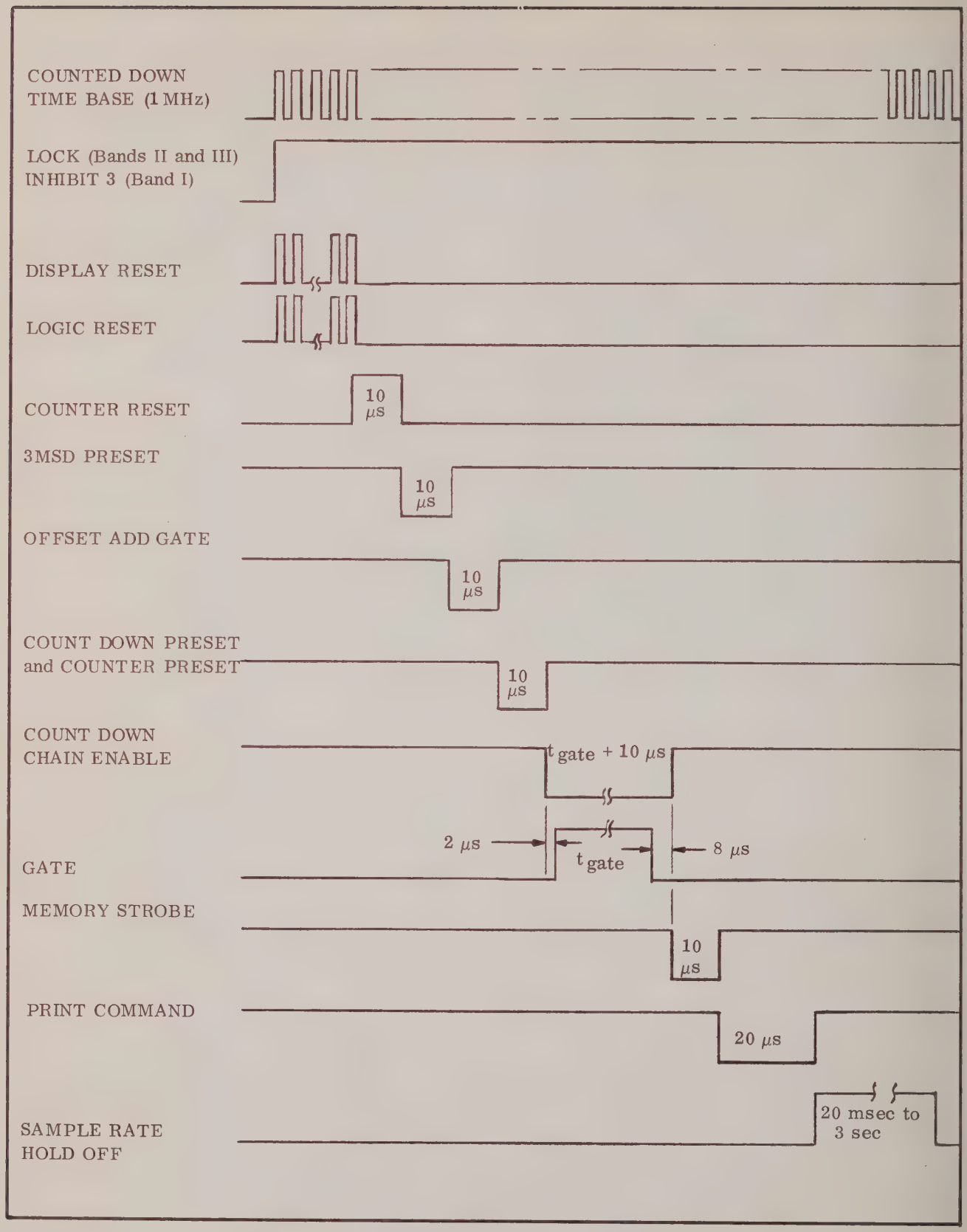


FIGURE 4-3 TYPICAL TIMING CYCLE

4-29. Transistor Q14 acts as a capacitor multiplier to obtain the long time constants (up to 3 seconds) required. With the application of the pulse, the one-shot output (IC4, pin 8) goes high, while the cross coupled gate output (IC16, pin 8) is latched low. This inhibits the sequence generator from further counting until the end of the hold-off time. At the end of the hold-off time, the one-shot output goes low, forcing the cross coupled output high and enabling the sequence generator to continue counting. The next count brings the sequence generator back to its starting point for a new cycle.

4-30. When the instrument is first turned on, transistor Q12 is switched on forcing the output of IC29 high and causing reset pulses to be generated. After approximately 1 second, capacitor C32 has charged sufficiently to turn on transistors Q10 and Q11, thus switching off transistor Q9. This insures that turn on transients will not cause an error in the first count.

4-31. HIGH FREQUENCY BOARD (A001)

4-32. High Frequency Board A001 (See Figures 9-6 and 9-7) contains two separate Amplifier/Schmitt trigger combinations: a high input impedance amplifier for operation from 20 Hz to 20 MHz, and a 50 ohm input impedance amplifier for the 1 MHz to 210 MHz range. These circuits drive separate flip flops. These flip flops in turn drive the high frequency decade counter chain. Level translators are used to provide the correct interface between T^2L and MECL logic. Amplifier selection is determined by energizing either relay K1 or K2.

4-33. The low frequency channel contains a diode limiter (CR10 and CR11), a FET (Q19) input stage, two cascaded differential amplifiers (part of IC1), and a Schmitt trigger (part of IC1). The Schmitt trigger threshold is set by R73. The Schmitt trigger drives flip flop (IC4) whose output is gated to the decade counter (IC7, IC8, IC10, and IC12).

4-34. Signals into the high frequency channel are limited by diodes CR1 and CR2, and then amplified by transistor Q1. This signal then drives a differential pair (Q2 and Q4). Emitter follower transistors Q5 and Q6 provide a low output impedance. The emitter follower outputs drive a Schmitt trigger consisting of differential pair Q8 and Q9 and tunnel diode CR6. Transistor Q7 provides balance compensation. R38 is used to balance the differential pair while R44 sets the Schmitt trigger threshold. The output of Q11 then drives a second Schmitt trigger consisting of differential pair Q13 and Q15 and tunnel diode CR8. R47 balances the differential pair. The output level from the second Schmitt trigger is then translated to MECL logic levels with differential pair Q16 and Q17. R57 is used to set the translator level. The final output signal passes through a driver (part of IC3) and appears at the inputs of a high speed flip flop (IC5) and a gate (part of IC3). For Band I, IC5 is enabled, resulting in a divide-by-two operation. For Band II and III, the gate (part of IC3) is enabled, thus bypassing the flip flop.

4-35. The outputs of both channels are fed to a 4-input NAND gate. The enable signal for this gate is the GATE command from the Control Logic Board (A002). The output of the NAND gate is counted down in a high frequency decade counter consisting of IC7, IC8, IC10, and IC12. Comparators IC9, IC11, IC13, and IC14 convert the MECL logic levels for the BCD outputs of this high frequency decade to T^2L logic levels.

4-36. Transistors Q20 through Q24 are level translators, converting the T^2L input commands from the Control Logic Board (A002) to MECL logic levels. The INHIBIT 1, 2, and 3 commands determine the proper signal path for the band selected (See Table 4-1). The GATE command allows the signal to be counted during the GATE period. The HFD RESET command resets the high frequency decade prior to counting.

4-37. DISPLAY BOARD (A003)

4-38. Display Board A003 (See Figures 9-8 and 9-9) contains the 11-digit NIXIE tube readout, the tube drivers memory elements, the count chain, and the tube blanking circuits. Each of the NIXIE tubes (VI through VII) has an associated driver (IC1 through IC11), which takes BCD information from a storage element (IC12 through IC22) and turns on the correct numeral. BCD information from the count chain (IC25 through IC33, IC37) and from the high frequency decade counter on the High Frequency Board (A001) is stored in the memory elements and updated upon application of the MEMORY STROBE command from the Control Logic Board (A002). Prior to counting, the three most significant digits are preset with BCD information from the Converter Control Board (A101).

4-39. For 10 Hz resolution (GATE not expanded), the high frequency decade output is gated directly into the 10 Hz decade with the overflow information driving the 100 Hz decade counter IC25. The 1 Hz digit is blanked. For 1 Hz resolution, pin 7 (GATE expand) is grounded. This causes information from the high frequency decade to be gated to the 1 Hz digit. The overflow is counted by IC37 and gated to the 10 Hz digit, while overflow from IC37 is gated to the 100 Hz digit (IC25).

4-40. Blanking of the most significant digits is accomplished with transistors Q1, Q2, and Q3. Selection of Band II applies 12 volts to pin 21, turning on Q3 which blanks the 10 GHz digit. In the low impedance mode of Band I (1 MHz to 210 MHz) 12 volts is applied to pin 22, turning on both Q2 and Q3 which blank both the 10 GHz and 1 GHz digits. In the high impedance mode of Band I (20 Hz to 20 MHz) 2.4 volts is applied to pin 20, turning on Q1 which blanks the 100 MHz digit.

4-41. Blanking of the least significant digits is accomplished by interrupting the 250 volt line to the tubes to be blanked. The switches are serially connected (See Figure 9-3) so that any switch blanks its own digit and all less significant digits.

4-42 AUTOHET CONVERTER OPERATION

4-43. General: Figure 4-1 is a simplified block diagram of the Autohet converters. The Band II and Band III converters are functionally identical with two exceptions: (1) In Band III a Power Control circuit is used to limit the power output of the Band III comb generator; (2) In the Model 351B, the Sweep Driver circuits contain a linearizing network to shape the YIG tuning current above 12 GHz.

4-44. Figure 9-3 is an interconnection diagram showing the interrelationship between the Autohet converter assemblies and the front panel control switches.

4-45. CONVERTER CONTROL BOARD (A101)

4-46. The Converter Control Board (A101) may be divided into three basic functional sections: Signal Acquisition Section, Sweep Driver Section, and Power Control Section. The signal acquisition circuits perform the functions of initiating the sweep drive and locking on to the proper comb line. The sweep driver circuits provide the required drive current to electronically tune the Band II (A109) and Band III (A102) comb generators and supply the three most significant digit presets to the counter. The power control circuits program the V_V input of the dual power amplifier (A106) to provide coarse leveling of the Band III comb generator (A102). Refer to Figure 9-10 for component locations and to Figure 9-11 for the schematic diagram.

4-47. SIGNAL ACQUISITION SECTION. The signal acquisition circuits provide the START, STOP, and LOCK commands. The START command is generated when an RF signal greater than the sensitivity threshold is connected to the input of the selected band. Its function is to initiate a scan of the appropriate comb generator. The STOP command is generated when the proper comb line from the comb generator is reached. Its function is to stop the comb generator scan and hold the YIG-tuned comb generator on the proper line. The LOCK command is generated approximately 10 milliseconds after the STOP command, provided that all signal levels are still sufficient for accurate counting. Its function is to enable the 210 MHz counter and initiate the count cycle.

4-48. For Band III operation, the input signal is detected in Mixer/Detector A105. The DC output of A105 (pin R) is amplified by operational amplifier IC16 and transistor Q40. The amplified output is compared to a reference level set by R251 in a comparator circuit including IC17. If the amplified signal exceeds this threshold, IC17 switches, turning off transistor Q43 and the START level goes to "1". Resistor R253 provides hysteresis for comparator IC17. Transistor Q41 is used to disable the Band III START circuit during Band II operation.

4-49. Band II operation is similar to Band III. The detected output from CR1 in the Mixer/Video amplifier A107 (pin 9) is compared in comparator IC18 to a reference level set by R143. Hysteresis is provided by R146. A sufficient signal level causes IC18 to switch, turning off transistor Q43 and changing the START level to "1". Transistor Q42 is used to disable the Band II START circuit during Band III operation.

4-50. The requirements for the generation of a STOP command are:

a. Presence of a START command.

b. Presence of a scan related IF signal between 8 MHz and 120 MHz.

c. IF signal level greater than STOP threshold level.

4-51. The IF outputs of High Gain Video Amplifier A104 (pin 21) and Mixer/Video Amplifier A107 (pin 20) are fed into relay K1 which selects the appropriate input. The signal then passes through an attenuator (R180, R181, and R182) and a 150 MHz low pass filter (L1, L2, C40, and C42). The signal is amplified by transistors Q49 and Q50, and actively limited by IC22. The limited output of IC22 then feeds two parallel low pass filters, one at 120 MHz and one at 8 MHz. The outputs of these filters are detected by diodes CR12 and CR13 respectively, and fed into differential amplifier IC23. If the difference in levels exceeds the offset set in by R197, the output of IC23 goes to "1", enabling gate IC26 (IC26 pins 1 and 4). This indicates that the IF frequency is between 8 MHz and 120 MHz.

4-52. Prior to limiting, the IF signal is also fed to detector diode CR17. The detected level is compared in comparator IC24 to the RESET threshold level set by R218. in addition, this level is AC coupled through C69 to comparator IC25 where it is compared to the STOP threshold level set by R229. The RESET threshold level is always set lower than the STOP threshold level.

4-53. If the signal level exceeds the STOP threshold level, the output from IC25 goes high enabling a gate in IC26 (pin 2) to indicate that the IF signal is scan related. If the other input to this gate is also high, indicating that the signal is IN BAND (between 8 MHz and 120 MHz; see paragraph 4.51), the output of this gate goes low.

4-54. A low input at IC26 pin 13 disables this normally enabled gate which in turn triggers a 10 msec one shot oscillator composed of Q53 and Q54. The 10 msec negative output pulse from the one shot sets a latch composed of a pair of cross-coupled gates (part of IC27 and IC28) if a START signal is present at IC27 pin 5. This latch is released only when the START signal is removed from IC27 pin 5.

4-55. In addition to setting the latch the output pulse from the one shot disables a gate in IC27 which is normally enabled, causing its output to go high. This high output enables another gate in IC27 generating a STOP command ("0") at IC27 pin 8, if a START command is present at the other input.

4-56. The STOP command is inverted in a gate of IC28 to enable a second gate in IC28. The other input to this second gate is simultaneously disabled for 10 msec by the output of the one shot. At the end of 10 msec this input goes high, causing the output of the gate to go low. This "0" is inverted in another gate of IC28 generating a LOCK command ("1") at IC28 pin 8.

4-57. Both the STOP and LOCK commands will remain at pins 19 and 18 respectively, as long as: the detected IF signal level remains above the RESET threshold level, the IF signal remains IN BAND, and a START command is present.

4-58. If the detected IF signal levels falls below the RESET threshold level, the output of IC24 goes low, disabling a gate in IC26 (at pin 4). If the IF signal goes out of band, this same gate is disabled at IC26 pin 5. The disabling of this gate logically results in the removal of both the STOP and LOCK commands. The loss of the START command from IC27 pin 9 also results in the removal of both the STOP and LOCK commands.

4-59. SWEEP DRIVER SECTION. The sweep driver circuit contains a clock, a digital to analog converter, a current driver, and logic circuits to provide resets.

4-60. The sweep driver circuits generate an analog sawtooth waveform that is used to tune the YIG-tuned Comb Generator. The sweep is controlled by means of a digital clock. Each clock pulse advances a counter one bit corresponding to a 2.5 MHz tuning step of the Band III YIG. In Band II, the tuning step is reduced to 1.25 MHz. When the YIG-tuned Comb Generator is locked onto a comb line, the digital number in the D/A counter is strobed and preset into the three-most-significant digits of the eleven-digit front panel display.

4-61. The sweep drive starts when a START command is received at pin 13. This signal is inverted by a gate in IC4 and is then AC coupled to the RESET gate in IC5 (pin 10). This signal momentarily disables the RESET gate (it is normally enabled), causing its output (IC15, pin 8) to go high. This voltage step, in turn, triggers a one shot oscillator (Q30 and Q31) which generates a pulse to reset the counter (IC6, IC7, IC8, IC9, and IC10) to zero.

4-62. The START command also enables the CLOCK GATE (a gate in IC5) allowing clock pulses from a unijunction oscillator (Q29) to step the counter (IC6, IC7, IC8, IC9, and IC10) at about a 40 KHz rate. The CLOCK GATE is disabled whenever the BAND SELECT switch is in the BAND I position, causing both inputs to a gate in IC3 to go high and its output (IC3, pin 3) to go low. The CLOCK GATE is also disabled by a STOP command ("O") at pin 14.

4-63. As the counter is stepped, its outputs are converted to current by two gates in IC4 and transistors Q1 through Q28. Each output bit adds a successively larger amount of current determined by R2, R4, R6 ... R26, R28, and R73 through R77. The amount of current added is carefully regulated by the tight tolerance on the above resistors and the temperature compensated reference voltage supplied by CR1 and IC2. [Note that when the BAND SELECT Switch is in the BAND III position, the gate in IC4 supplying the current for the counter's least significant bit (equal to a 1.25 MHz step) is disabled, and that the second ÷ by 2 stage in IC6 is bypassed (with 3 gates in IC3) effectively doubling the drive rate of the counter's second least significant bit.]

4-64. The currents generated are summed by operational amplifier IC1. The output of IC1 is converted to a current (by one of two current drivers) which is sufficient to sweep the Band II or Band III YIG-tuned comb generator. The Band II current driver (consisting of operational amplifier IC20, predriver transistor Q47, and chassis mounted transistor Q1), is enabled by Q46 upon receipt of a Band II enable command. The Band III current driver (consisting of operational amplifier IC19, predriver transistor Q45, and chassis mounted transistor Q2), is enabled by Q44 upon receipt of a Band III enable command.

4-65. Whenever a STOP command ("O") is generated, the CLOCK GATE is disabled, stopping the upward count of the D/A converter. Simultaneously a gate in IC4 is disabled, causing a small backward step in the D/A output. The size of the step is controlled by R72. This step compensates for the time lag in the YIG-tuned comb generators due to eddy currents generated by the changing magnetic field.

4-66. In the event that either the START or STOP command is lost, a pulse is generated which disables the RESET gate in IC5 and consequentially resets the D/A converter to zero. The RESET gate is also disabled, resetting the D/A converter to zero when the outputs of IC9 and IC10 reach a predetermined limit for Band II and Band III. The Band II upper limit command is given by IC11 pin 6, and the Band III upper limit RESET command is given by IC11 pin 8.

4-67. On the Model 351B only, the sweep driver circuits also contain a single breakpoint linearizer network to correct for nonlinearity in the Band III comb generator tuning characteristic from 13.5 to 18 GHz. The current provided by operational amplifier IC21 and transistor Q48 is summed by the chassis mounted driver transistor Q2. Current slope is determined by R177 while the start point is controlled by R173.

4-68. POWER CONTROL SECTION. The power control circuit provides the capability for reducing the power output of the Band III comb generator (A102) during the sweep period. This power reduction is accomplished by varying the V_V level to the dual power amplifier (A106). As V_V is lowered, the output of A106 is also lowered. The V_V level is independently variable over three selective portions of the Band III frequency range.

4-69. Three identical dual comparator circuits (IC12, IC13, and IC14) are used to divide the Band III frequency range into three portions. The voltage across chassis mounted sampling resistor R1 is compared to the high and low level references for each comparator circuit. Whenever this voltage falls between the high and low limits, the comparator's output goes low, turning off a transistor switch (either Q34, Q35, or Q36). This allows current to flow into summing amplifier IC15 at a level set by a series resistor (either R110, R117, or R132). The high and low level references are set for IC12 by R104 and R105, for IC13 by R111 and R112, and for IC14 by R126 and R127.

4-70. Transistors Q37 and Q38 amplify the output of IC15. The more current aupplied through R110, R117, and R132, the lower the output of IC15 will be. As the output of IC15 is lowered, the output of Q37 and Q38, and thus V_V, is also lowered. Since comb power reduction is desired only during the sweep cycle in Band III, transistor Q39 acts as a switch to override IC15 whenever a STOP command is generated, in order to return V_V to maximum output.

4-71. PHASE LOCKED OSCILLATOR (A132)

4-72. Phase locked oscillator A132 (See Figures 9-12 and 9-13) consists of a 20 MHz oscillator which is phase locked to a 1 MHz signal derived from the 5 MHz crystal oscillator or from an external reference frequency oscillator. The 1 MHz clock input (J1) drives the "set input of the digital phase detector flip flop (½ of IC4). This sets the output (IC4, pin 9) high, applying a "1" to AND gate IC5 (pin 3).

4-73. The basic elements of the 20 MHz voltage-controlled oscillator are: Q1, Y1, VD1, T1, C11, and C13. The output of this oscillator is applied to the driver (½ of IC1, pin 7) through R11 and C2. Its output drives flip flop IC2 which divides the oscillator frequency by 2 (to 10 MHz). This drives decade counter IC3. The output of decade counter IC3 (1 MHz) is applied to the second phase detector flip flop (½ of IC4). The output of IC4 pin 12 is compared against the reference input signal by AND gate IC5. Whenever IC5 pins 2 and 3 are high, gate output IC5 pin 1 goes low and resets both flip flops in IC4. Thus, the pulse width on IC4 pin 12 or pin 9 represents the phase difference between the VCO and the reference signal. These pulses are applied to differential amplifier IC6. Capacitors C14 and C15 form the phase loop filter. The output of IC6 is applied to varactor VD1 which controls the oscillator frequency. The oscillator signal is coupled through T1 to the attenuator formed by R13, R14, R15, and to the output J2. FL3 is the phase lock monitor point, and allows a check of the error voltage of the phase locked loop (this is between +1 and -1 volts when the 20 MHz oscillator is phase locked to the reference signal).

4-74. X5 MULTIPLIER (A133)

4-75. The X5 multiplier (A133) translates the 20 MHz output of the phase locked oscillator up to 100 MHz (See Figures 9-14 and 9-15). The 20 MHz input is applied to an amplifier (Q1) through an attenuator consisting of R1 and R2. The output of Q1 is matched to the input of the multiplier stage (Q2) by L1 and C4. The output of Q2 is tuned to 100 MHz by the combination of L2, C7, and C8 and drives an amplifier (Q3) which is biased for Class C operation. The output of Q3 is filtered by a 5-pole network to attenuate undesired harmonics.

4-76 DUAL POWER AMPLIFIER (A106)

4-77. Dual power amplifier A106 (See Figures 9-16 and 9-17) provides the high power drive levels for both the Band II and Band III YIG-tuned comb generators (A109 and A102). The power output of this amplifier is programmed through the V_V (variable voltage) input FL2 to provide coarse leveling of the YIG-tuned comb generator output above 1.2 GHz. V_V varies from +5 to +12 volts as a function of the swept frequency.

4-78. The 100 MHz input signal is applied to input network C11/L2. Q1 is biased for linear operation by R1, R2, and R3. The collector load T1 is tuned to 100 MHz, and the secondary of T1 feeds amplifier Q2. C3, C5, and RFC5 are decoupling elements for the supply voltage of Q1. Transistors Q2 and Q3 operate in Class C and their supply voltage, V_V, is decoupled by C6, C9, and RFC1 through RFC4. The output network consists of the tuned elements C10, T2, and the attenuator R6, R7, and R8 for the high power output (J1). The secondary of T2 provides the lower power output (J2). The output power of the amplifier is a function of V_V. This allows the power to be programmed as a function of frequency in Band III. In Band II, V_V is set at 12 volts.

4-79. BAND II COMB GENERATOR (A109)

4-80. The Band II comb generator (A109) is driven from the low power output (J2) of dual power amplifier A106, and is electronically tuned by the Sweep Driver Section of A101 to select the appropriate comb line for the 0.210 GHz to 1.2 GHz input range. The unit consists of an input matching network, a self biasing network, a step recovery diode and a YIG filter. Self-regulating heaters are provided for the YIG filter and operate from the +18 volt supply.

4-81. MIXER/VIDEO AMPLIFIER (A107)

4-82. The input signal in the 210 MHz to 1.2 GHz range is coupled into Mixer/Video Amplifier A107 (See Figures 9-18 and 9-19) where it is heterodyned against the 100 MHz comb lines of the Band II YIG-tuned comb generator (A109). The difference frequency is amplified in the video amplifier portion of this assembly, with the output signal coupled into Converter Control Board A101. Mixer video amplifier A107 also contains a circuit that detects the presence of a CW input signal and triggers a sweep START command on Converter Control Board A101.

4-83. The mixer consists of two diodes (CR2 and CR3) in a balanced mixer circuit, in order to minimize the generation of even order harmonics of both the input signal and the selected mixing frequency. Terminating resistor R1 and inductor L1, together with the diode capacitance, gives an input impedance of 50 ohms. (VSWR is typically less than 2:1.) The non-linearity of diodes CR2 and CR3 generates signals with frequencies which are the sum and difference of the two mixing frequencies. The difference frequency signal is coupled to the input of differential amplifier IC1. The video bandwidth is 120 MHz.

4-84. The output of IC1 is applied to feedback amplifier Q1/Q2. The signal is further amplified by an additional feedback amplifier, Q3/Q4. The output of Q4 drives a 50 ohm cable which is terminated on Converter Control Board A101.

4-85. The presence of an input signal at J1 is detected by CR1. The DC output of CR1 is coupled to Converter Control Board A101 to trigger a START command.

4-86. BAND III COMB GENERATOR (A102)

4-87. Band III Comb Generator A102 is driven from the high power output (J1) of dual power amplifier A106. It is electronically tuned by Converter Control Board A101 to select the appropriate comb line for the 1.2 to 12.4 GHz range (Model 350B), or 1.2 to 18 GHz range (Model 351B).

4-88. Band III Comb Generator A102 consists of an input matching network, a step-recovery diode, an output matching section, and a YIG filter. All elements are contained inside this assembly. A102 is tuned by varying the magnetic field across the YIG material. The output of the comb generator is coupled into mixer/detector A105 through coupler A103.

4-89 BAND III MIXER (A103/A105)

4-90. The input signal to Band III is fed through a broad band attenuator (J3) into coupler A103 and then into mixer/detector A105. The output of the high band comb generator A102 is also fed into coupler A103 and then into mixer/detector A105. The two signals are heterodyned together to produce a difference signal in the frequency range of 0 to 120 MHz. A105 consists of a back diode, DC return, input matching structure and an RF bypass capacitor.

4-91. In addition to the mixing function, A105 serves to detect the presence of an input signal. For this reason, the output of A105 is DC coupled through high gain video amplifier A104 to Converter Control Board A101.

4-92 HIGH GAIN VIDEO AMPLIFIER (A104)

4-93. The difference frequency (0 to 120 MHz) output from the Band III mixer (A103/A105) is amplified in high gain video amplifier A104, and applied to Converter Control Board A101 (See Figures 9-20 and 9-21). The DC output of the Band III mixer (A103/A105) is decoupled from the video signal and brought out directly without amplification on FL2.

4-94. The AC and DC components of the video signal from the mixer diode (A105) are applied to J2 of high gain video amplifier A104. The DC component is directly coupled through filter FL2 to Converter Control Board A101, which maintains a zero volt operating point for the mixer. The video amplifier consists of two current feedback low noise amplifiers (Q1/Q2 and Q3/Q4), three voltage feedback amplifiers (Q5/Q6, Q7/Q8, and Q9/Q10), and one active limiter (IC1). The limiter is required to reduce the dynamic range requirements of output amplifier Q9/Q10. The limiter is a symmetrical limiter and, therefore, generates only odd order harmonics that do not influence the counter accuracy.

4-95. POWER SUPPLY OPERATION

4-96. General - The power supply is mounted on the rear panel of the instrument. It provides an unregulated output of 250 volts and regulated outputs of: +14, +18, +12, and +5 volts. The power supply consists of two assemblies: The A005 Power Supply Subassembly, and the A006 Regulator Board.

4-97. POWER SUPPLY SUBASSEMBLY (A005)

4-98. Power Supply Subassembly (A005) provides the unregulated outputs for all the supply voltages. It contains the transformers, rectifier bridges, and filtering for the Regulator Board (A006). In addition, it contains the fan (B1), fuses (F1 and F2), and the 115/230 volt switch (S32). (See Figures 9-22 and 9-23)

4-99. The two transformers T1 and T2 have dual primaries and can be wired for either 115 or 230 Vac operation. The rear panel 115/230 volt slide switch programs the transformers for the selected operating voltage. Transformer T1 is controlled by the front panel ON-OFF switch. Transformer T2 supplies the power to the 5 MHz crystal oscillator oven and is on whenever the unit is plugged in.

4-100. The 250 volt supply consists of rectifier bridge CR1, and filter capacitor C2. Bleeder Resistor R1 discharges the capacitor when the unit is turned off. Fuse F1 is mounted on the rectifier board (See Figure 9-22).

4-101. The unregulated supply for +5 volts consists of rectifier bridge CR2 and an LC filter consisting of L1 and C4. The unregulated voltages for the +12, -12, and +14 volt supplies all consist of a rectifier bridge (CR3, CR4, or CR5 through CR8) and a filter capacitor (C6, C8, or C10).

4-102. REGULATOR BOARD (A006)

4-103. Regulator Board A006 (See Figures 9-22 and 9-23) provides the regulated outputs and foldback current limiting for the +5, +12, -12, and +14 volt supplies. Each of the four supplies contains an integrated circuit regulator, pass transistors for current handling capability, protective diodes, and a resistor network for foldback current limiting. Adjustment potentiometers are provided for setting all output voltages.

4-104. Regulation for the +14 volt supply is provided by regulator IC5. The output voltage is divided down by R37, R38, and R39 and sensed at pin 6 of IC5 where it is compared to an internal temperature compensated reference. The regulator output (IC5, pin 2) drives transistors Q11, Q12, and Q13 which provide the necessary current. Foldback limiting is accomplished with resistors R34, R35, and R36 and the internal circuitry of IC5. CR10 and CR11 are protective diodes.

4-105. Operation of the +5 volt supply is essentially identical to the +14 volt supply except that the final pass transistor Q1 is operated from a different unregulated supply than are Q2, Q3, and IC1.

4-106. Operation of the +12 volt supply is also essentially identical to the +14 volt supply except that only two pass transistors (Q6 and Q7) are required.

4-107. The -12 volt supply is a slightly different circuit, due to internal differences in the negative regulator (IC4). The output voltage is determined by R23 and R26. Zener diode CR7 and resistor R25 form a preregulator for IC4. The output of IC4 drives pass transistors Q9 and Q10 which provide the necessary current. Foldback current limiting is accomplished with transistor Q8, resistors R31, R27, and R29, and the internal circuitry of IC4.

4-108. The +18 volt supply used for the Band II Comb Generator is derived from the same unregulated supply as the +14 volts. Zener diode CR3 maintains a constant voltage on the base of pass transistor Q14. Resistors R40 and R41 are current limiting resistors.

SECTION V

MAINTENANCE AND CALIBRATION

5-1. GENERAL

5-2. This section provides instructions and information necessary to maintain, calibrate, and troubleshoot the 350B/351B Autohet Counter.

5-3. HIGH VOLTAGE PRECAUTION

WARNING

250 VOLTS INSIDE CASE

250 VDC APPEARS AT THE FOLLOWING LOCATIONS:

a. Rectifier board directly behind Time Base Clock.

b. Display Board near NIXIE tubes.

c. Inside front panel at display blanking switches.

5-4. FUSE REPLACEMENT

5-5. The 350B/351B Autohet Counter has two fuses: a line fuse located on the rear panel and a fuse for the 250 volt NIXIE tube supply located on the rectifier board behind the Time Base Oscillator. For proper operation with either 115 or 230 Vac, use only the fuses listed below and set the rear panel slide switch for proper voltage.

AC Line Voltage	115 Vac	230 Vac
Slide switch	115	230
AC Line Fuse	1 Amp - Quick Acting	0.5 Amp - Quick Acting
250 V Fuse	1/16 Amp - Quick Acting	1/16 Amp - Quick Acting

5-6. PERIODIC MAINTENANCE

5-7. AIR FILTER

5-8. Inspect the air filter (on rear panel) regularly; clean it before it becomes dirty enough to restrict air flow. Proceed as follows:

CAUTION

DO NOT APPLY ANY COATING COMPOUND TO FILTER

a. Remove four screws holding filter in place.

b. Wash filter in warm water and detergent.

c. Allow filter to dry completely.

d. Install filter and tighten the four screws.

5-9. TIME BASE CALIBRATION

5-10. The frequency accuracy of the 350B/351B is determined by the 5 MHz Time Base Clock (A004). A periodic check and adjustment (if required) of the frequency is recommended in order to maintain high accuracy.

5-11. Test Equipment Required (as specified, or equivalent).

a. Oscilloscope: HP 140A, 1400B, 1421A

b. Frequency Standard: HP 105A

c. VLF Comparator: HP 117A

5-12. Figure 5-1 shows the test setup for determining the accuracy of the Time Base Clock (A004). The frequency accuracy is determined by observing the drift of the oscilloscope pattern.

5-13. All of the frequency checks and adjustments should only be made after the counter has been connected to AC power for 24 hours. If the counter has been disconnected from AC power for more than 24 hours, it may require 72 hours of continuous operation to achieve the specified frequency aging rate.

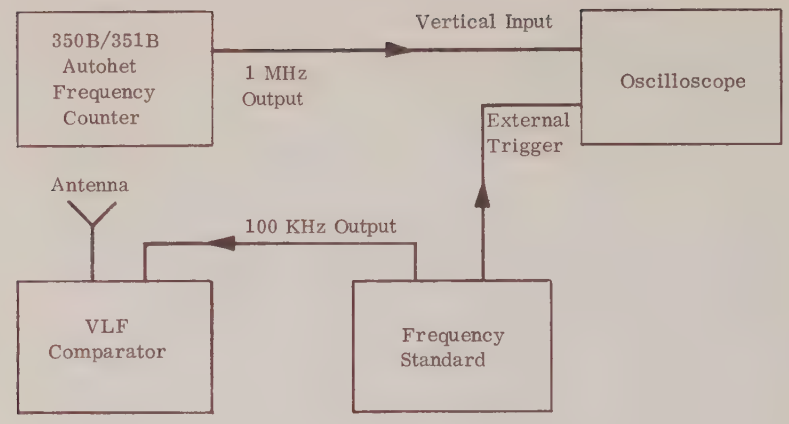


FIGURE 5-1. TIME BASE CALIBRATION SETUP

5-14. To measure Time Base Clock frequency, proceed as follows:

a. Connect 1 MHz output from rear panel of the 350B/351B to the vertical input of the oscilloscope.

b. Trigger oscilloscope externally with the frequency standard. The VLF comparator is used to determine the absolute frequency of the frequency standard.

c. Set oscilloscope sweep rate to .1 μsec/cm, expand to X10; this gives a sweep time of .01 μsec/cm.

d. Adjust oscilloscope vertical controls to obtain maximum vertical gain.

e. Horizontal drift of oscilloscope display in cm/sec is difference between standard frequency and Time Base Clock frequency.

f. If the oscilloscope pattern drifts to the left at a rate of 1 cm with every 10 seconds, the frequency is 1 part in 10^9 high.

g. Determine the frequency difference.

h. If the frequency difference is excessive for the desired application of the counter, vary Frequency Adjust control (R1 on rear panel) until oscilloscope pattern stops drifting. Note: For highest accuracy, unit should be operated continuously for 72 hours prior to adjustment.

5-15. Troubleshooting

5-16. The EIP Model 350B/351B Autohet Counter has been designed for reliable, trouble-free operation. In the event of a malfunction however, repair time can be minimized by making full use of the Troubleshooting Aids listed in paragraph 5-18 and following the systematic procedures in the Troubleshooting Trees. Servicing the 20 Hz to 210 MHz counter is facilitated by the hinged connector for the High Frequency Board (A001). This allows A001 to be rotated to a vertical position for work on the Control Logic Board (A002). Access to the Display Board (A003) is obtained by removing the Control Logic Board (A002) and inserting a right angle PC Board Extender (A007) which is available as a service accessory (EIP Part Number 100740). Note: Units equipped with Option 04 (BCD output) include a right angle PC board assembly which is suitable for use as an extender. It is necessary to first remove the BCD board (A008) for access to this assembly. With the extender in place, the Control Logic Board may be replaced in a vertical position.

5-17. All printed circuit boards are field serviceable. All module assemblies are field replaceable. Although field servicing is possible on some modules (A104, A105, A106, A107, A132, and A133), it is recommended that these modules be replaced rather than serviced. EIP stocks all of these modules and will provide them on an exchange basis at nominal cost. (See ordering information - Paragraph 8-3.)

CAUTION

In no event should field service be attempted on any of the following assemblies:

a. Time Base Clock (A004)

b. Band II Comb Generator (A109)

c. Band III Comb Generator (A102)

d. Coupler (A103)

5-18. TROUBLESHOOTING AIDS

5-19. Operation - The first three sections of this manual provide general information about the 350B/351B Autohet Counter. Refer to these sections for specifications, instrument operation and a self-check procedure.

5-20. Theory of Operation - Refer to Section IV for a detailed description of the operation of the 350B/351B Autohet Counter and its individual assemblies.

5-21. Schematic Diagrams and Component Locations - Section IX shows schematic diagrams, component locations, inter-connect diagrams and assembly locations. Refer to these for detailed troubleshooting.

5-22. Troubleshooting "Tree" - A step-by-step troubleshooting procedure is provided in Figures 5-2 and 5-6. This procedure is divided into four sections corresponding to the four operating frequency ranges of the instrument, plus a fifth section on the power supply.

5-23. Troubleshooting Procedure

5-24. TEST EQUIPMENT REQUIRED

5-25. The test equipment required for troubleshooting is as follows (or equivalent):

a. Signal Source, 0.1 to 18 GHz: HP 8690B, 8699B, 8693B, 8694B, and 8695A (351B only).

b. Digital Voltmeter (4-1/2 digit): Preston 723A.

c. Detector, calibrated: HP 8472A.

d. Attenuators - 6, 10, and 20 dB: HP 8491B.

e. Signal Source, 20 Hz - 10 MHz: HP 651B.

f. Oscilloscope, HP 140A, with HP 1402 A and 1400 B plug-ins.

g. Sweep Oscillator, Texscan VS-80.

5-26. MALFUNCTION AT TURN ON

5-27. If counter fails to turn on (no display, no fan, or no gate light), make the following checks:

a. Line voltage switch in proper setting.

b. Power cord plugged into counter and power source.

c. AC power available at power source.

d. Line fuse good.

e. Internal 250 volt fuse good.

f. Power switch set to ON.

g. Power supply (A005 and A006). Refer to Troubleshooting Tree Section (Figure 5-6) if bad.

h. Power supply buss wiring (See Figure 9-3).

5-28. MALFUNCTION DURING SELF TEST

5-29. If counter turns on but fails to give correct reading (1 MHz) when the TEST button is depressed, check that:

(a) Time Base INT/EXT switch is set to INT.

(b) Refer to Figure 5-2, Band I - 20 Hz to 20 MHz - Troubleshooting Tree (Part 1).

5-30. MALFUNCTION DURING OPERATION IN BAND I (20 Hz to 20 MHz)

5-31. If no reading or incorrect reading obtained, check that:

(a) Unit operates correctly when TEST button is pressed. (If not, refer to Paragraph 5-29.)

(b) BAND SELECT switch is in Band I (20 Hz - 210 MHz) position.

(c) Mode switch is in proper position (20 Hz - 20 MHz).

(d) Signal is applied to correct input.

(e) Signal level and frequency range are correct.

(f) SAMPLE RATE control is not in HOLD position.

(g) Following items are OK:

(1) Cable from input connector to High Frequency Board (A001) and relay A001K2.

(2) BAND SELECT switch and Mode switch (bad contacts or broken wires).

(h) If no reading or incorrect reading obtained, refer to Part 1 of Troubleshooting Tree (Figure 5-3).

5-32. MALFUNCTION DURING OPERATION IN BAND I (1 MHz to 210 MHz)

5-33. If no reading or incorrect reading is obtained, check that:

(a) Unit operates correctly when TEST button is pressed. (If not, refer to Paragraph 5-28.)

(b) BAND SELECT switch is in Band I (20 Hz - 210 MHz) position.

(c) Mode switch is in proper position (1 MHz - 210 MHz).

(d) Signal is applied to correct input.

(e) Signal level and frequency range are correct.

(f) SAMPLE RATE control is not in HOLD position.

(g) If no reading or incorrect reading obtained, refer to Part 2 of Troubleshooting Tree (Figure 5-3).

5-34. MALFUNCTION DURING OPERATION IN BAND II or BAND III

5-35. If no reading or incorrect reading is obtained, check that:

(a) Unit operates correctly when TEST button is pressed. (If not, refer to Paragraph 5-28.)

(b) Unit operates correctly in Band I. (If not, refer to Paragraphs 5-28 and 5-30.)

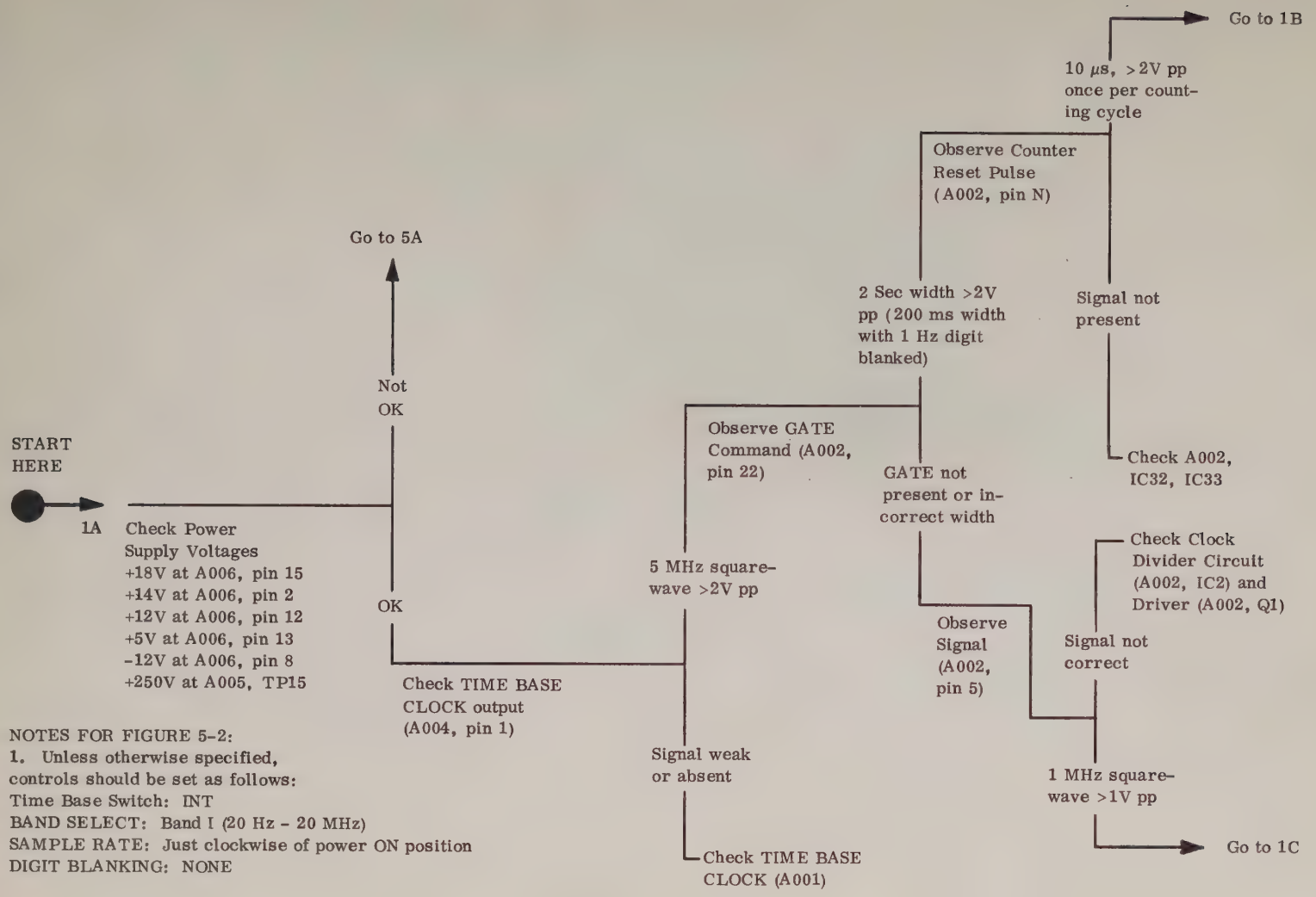
(c) BAND SELECT switch is in proper position.

(d) Signal is applied to correct input.

(e) Signal level and frequency range are correct.

(f) SAMPLE RATE control is not in HOLD position.

(g) If no reading or incorrect reading obtained, refer to Part 3 (Band II) (Figure 5-4), or Part 4 (Band III) (Figure 5-5) of Troubleshooting Tree.


START HERE
1A
Check Power Supply Voltages
+18V at A006, pin 15
+14V at A006, pin 2
+12V at A006, pin 12
+5V at A006, pin 13
-12V at A006, pin 8
+250V at A005, TP15
Not OK
Go to 5A
OK
Check TIME BASE CLOCK output (A004, pin 1)
Signal weak or absent
Check TIME BASE CLOCK (A001)
5 MHz square-wave >2V pp
Observe GATE Command (A002, pin 22)
2 Sec width >2V pp (200 ms width with 1 Hz digit blanked)
GATE not present or incorrect width
Observe Signal (A002, pin 5)
Signal not correct
Check Clock Divider Circuit (A002, IC2) and Driver (A002, Q1)
1 MHz square-wave >1V pp
Go to 1C
Observe Counter Reset Pulse (A002, pin N)
10 μs, >2V pp once per counting cycle
Signal not present
Check A002, IC32, IC33
Go to 1B

NOTES FOR FIGURE 5-2:
1. Unless otherwise specified, controls should be set as follows:
Time Base Switch: INT
BAND SELECT: Band I (20 Hz - 20 MHz)
SAMPLE RATE: Just clockwise of power ON position
DIGIT BLANKING: NONE

FIGURE 5-2a. BAND I (20 Hz - 20 MHz) TROUBLESHOOTING TREE (Part 1)

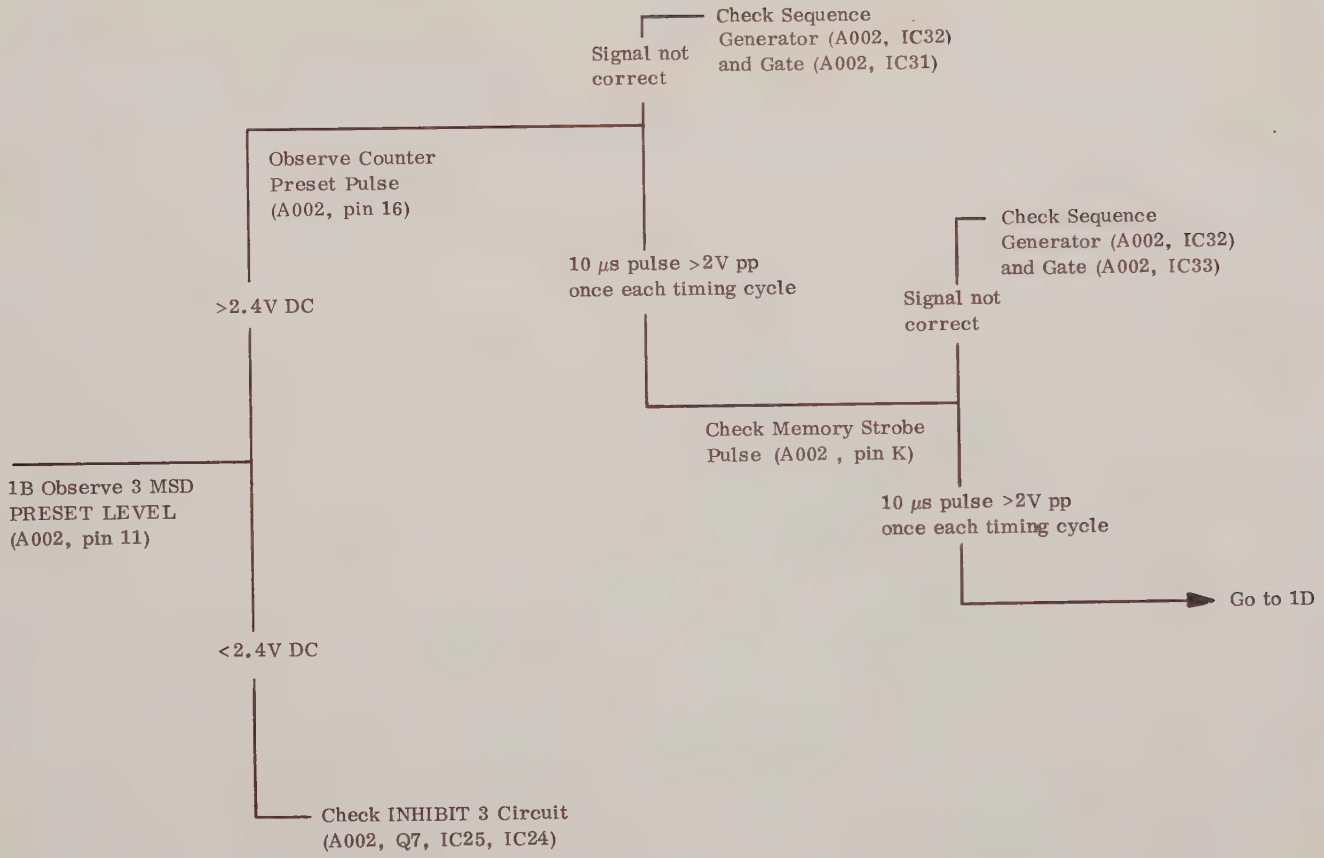

Check Sequence Generator (A002, IC32) and Gate (A002, IC31)
Signal not correct
Observe Counter Preset Pulse (A002, pin 16)
>2.4V DC
10 μs pulse >2V pp once each timing cycle
Check Sequence Generator (A002, IC32) and Gate (A002, IC33)
Signal not correct
Check Memory Strobe Pulse (A002 , pin K)
10 μs pulse >2V pp once each timing cycle
Go to 1D
1B Observe 3 MSD PRESET LEVEL (A002, pin 11)
<2.4V DC
Check INHIBIT 3 Circuit (A002, Q7, IC25, IC24)

FIGURE 5-2b. BAND I (20 Hz - 20 MHz) TROUBLESHOOTING TREE (Part 1)

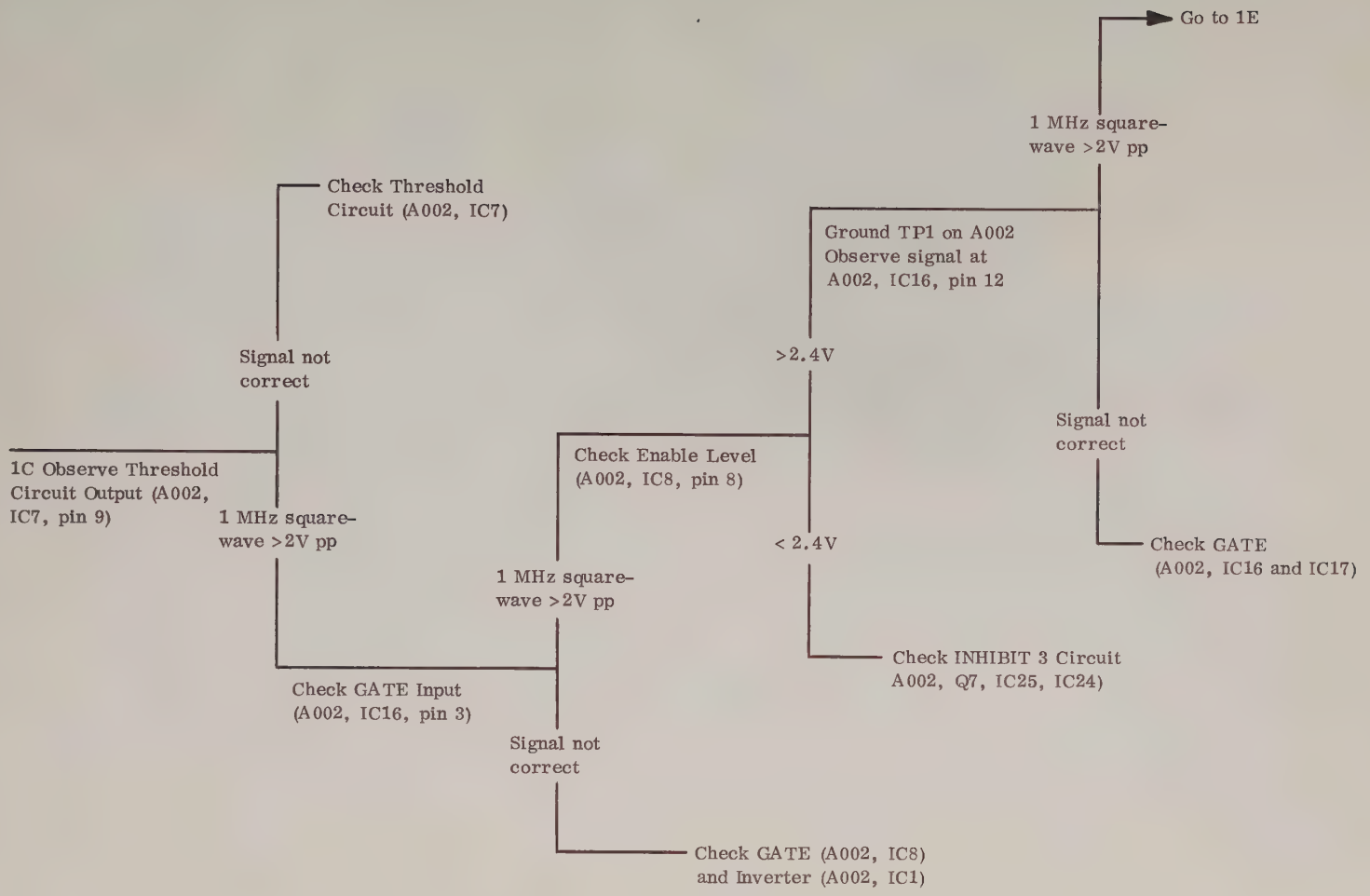


FIGURE 5-2c. BAND I (20 Hz - 20 MHz) TROUBLESHOOTING TREE (Part 1)

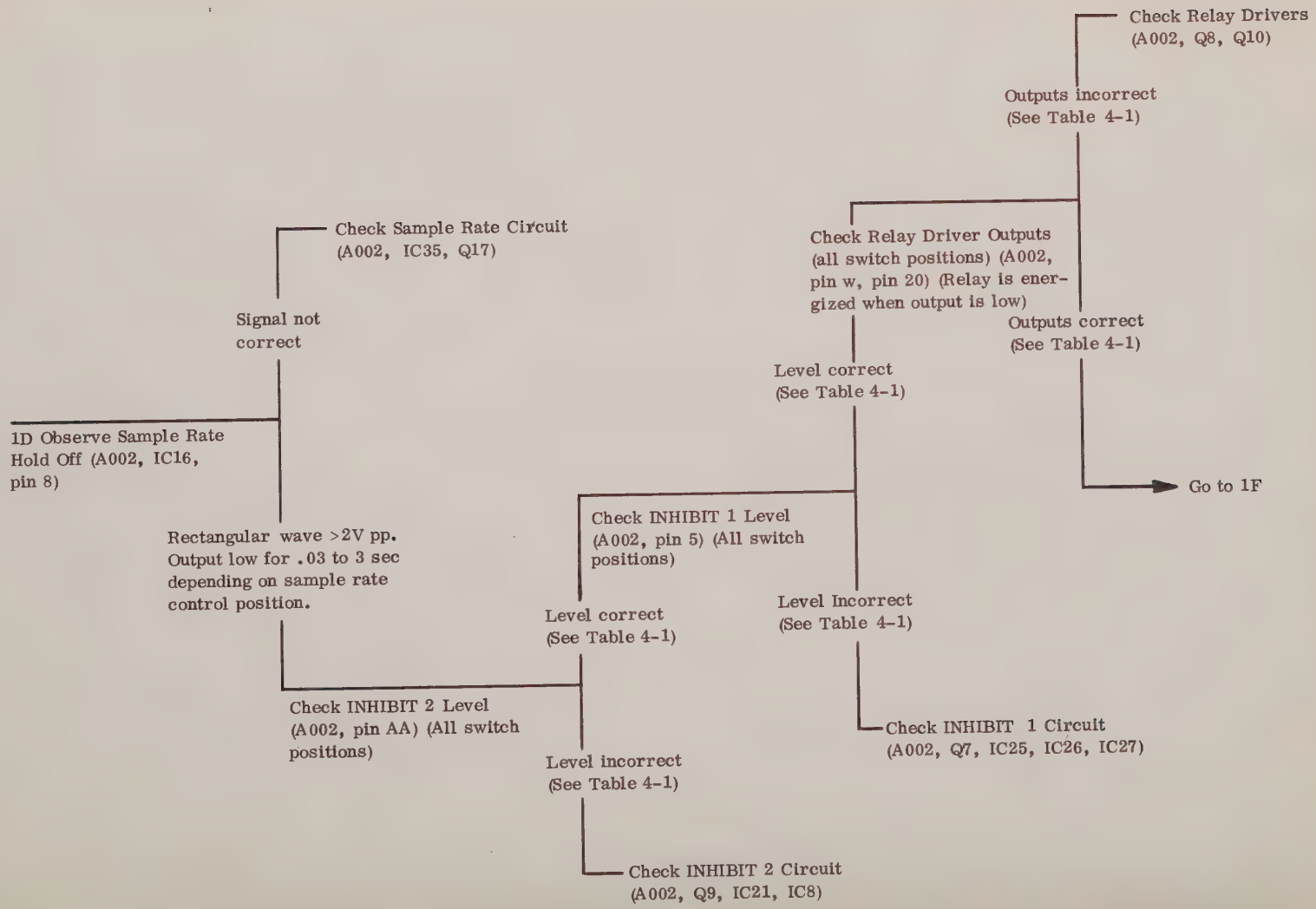


FIGURE 5-2d. BAND I (20 Hz - 20 MHz) TROUBLESHOOTING TREE (Part 1)

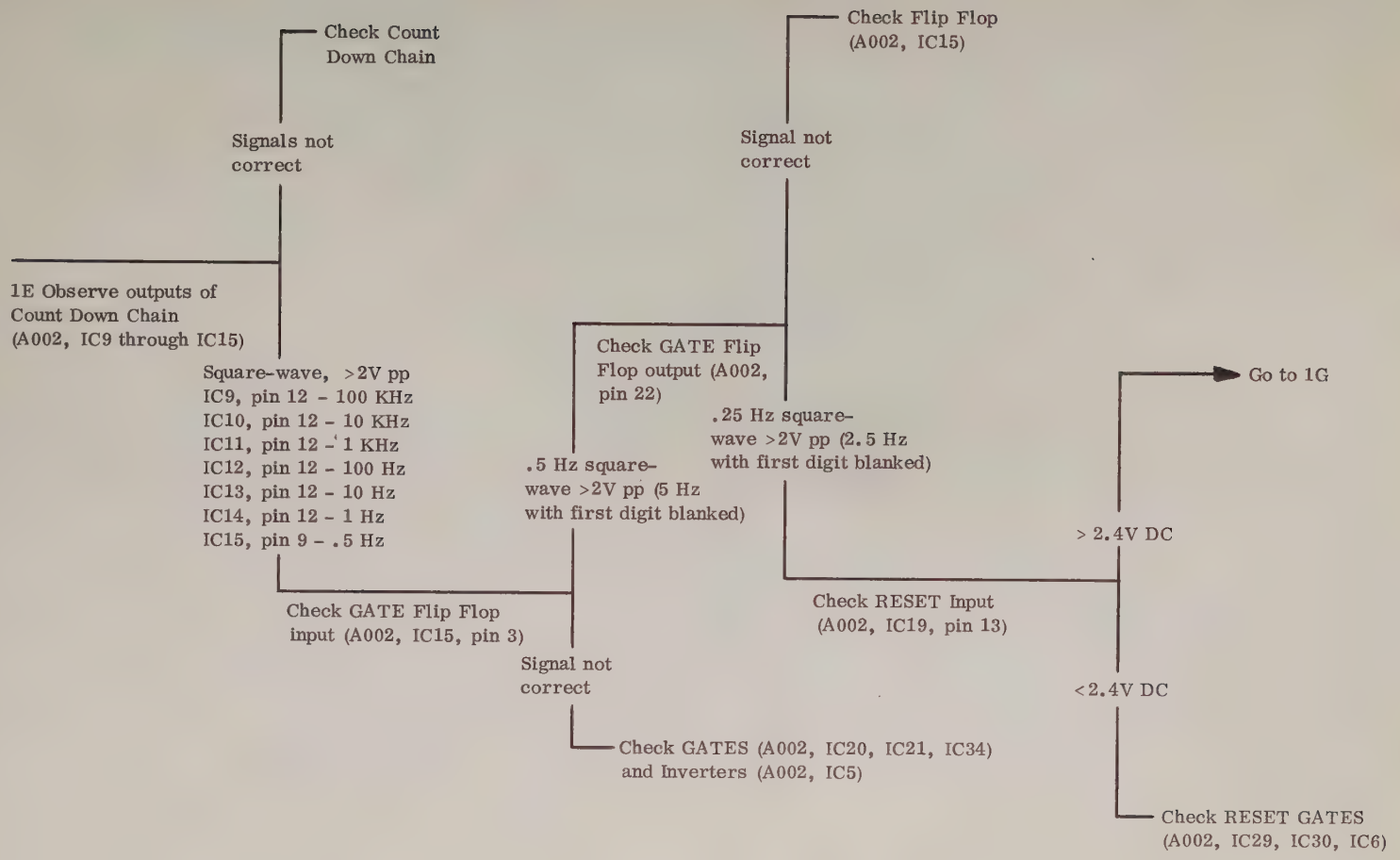

Check Count Down Chain
Signals not correct
1E Observe outputs of Count Down Chain (A002, IC9 through IC15)
Square-wave, >2V pp
IC9, pin 12 - 100 KHz
IC10, pin 12 - 10 KHz
IC11, pin 12 - 1 KHz
IC12, pin 12 - 100 Hz
IC13, pin 12 - 10 Hz
IC14, pin 12 - 1 Hz
IC15, pin 9 - .5 Hz
Check GATE Flip Flop input (A002, IC15, pin 3)
Check Flip Flop (A002, IC15)
Signal not correct
Check GATE Flip Flop output (A002, pin 22)
.5 Hz square-wave >2V pp (5 Hz with first digit blanked)
.25 Hz square-wave >2V pp (2.5 Hz with first digit blanked)
Signal not correct
Check GATES (A002, IC20, IC21, IC34) and Inverters (A002, IC5)
Go to 1G
> 2.4V DC
Check RESET Input (A002, IC19, pin 13)
<2.4V DC
Check RESET GATES (A002, IC29, IC30, IC6)

FIGURE 5-2e. BAND I (20 Hz - 20 MHz) TROUBLESHOOTING TREE (Part 1)

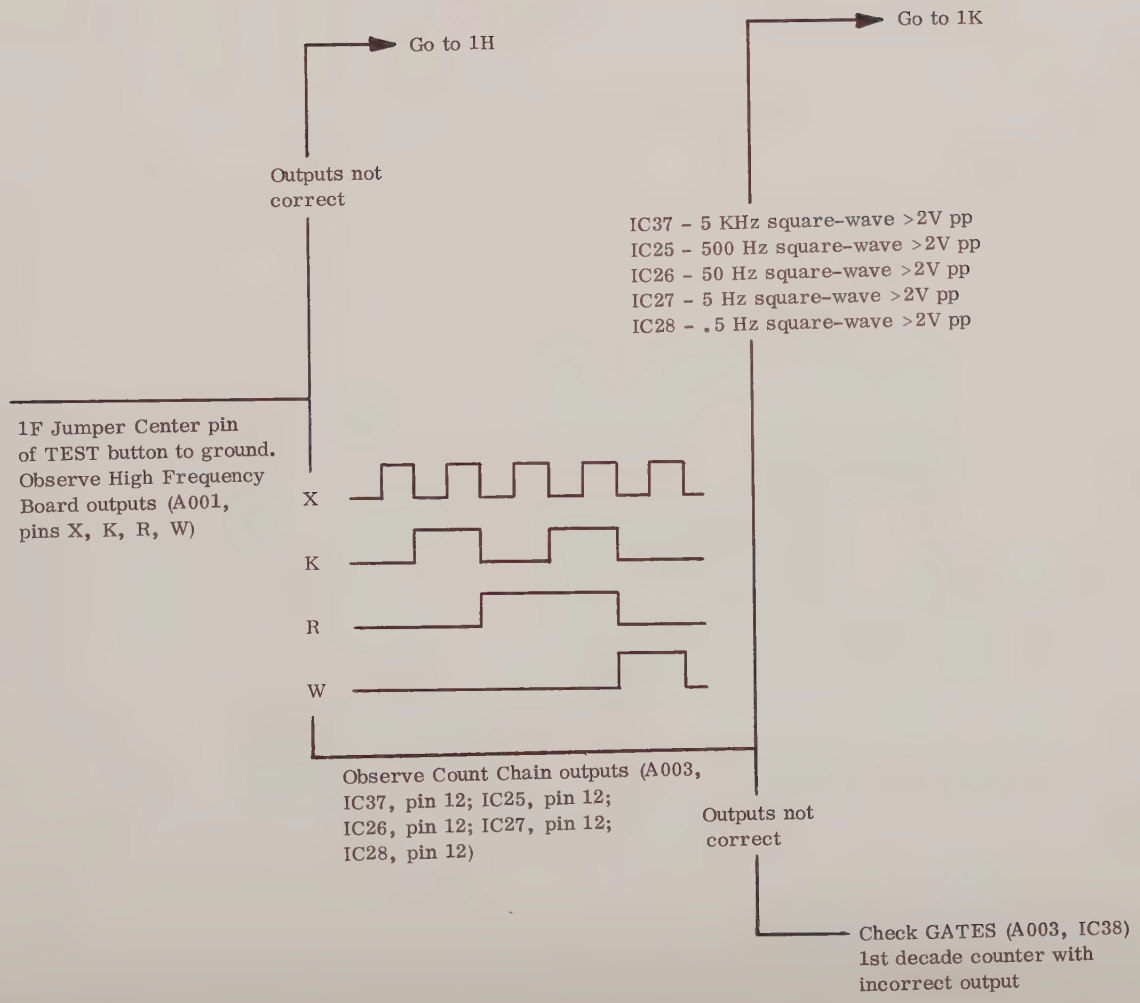

Go to 1H
Outputs not correct
Go to 1K
IC37 - 5 KHz square-wave >2V pp
IC25 - 500 Hz square-wave >2V pp
IC26 - 50 Hz square-wave >2V pp
IC27 - 5 Hz square-wave >2V pp
IC28 - .5 Hz square-wave >2V pp
1F Jumper Center pin of TEST button to ground. Observe High Frequency Board outputs (A001, pins X, K, R, W)
X
K
R
W
Observe Count Chain outputs (A003, IC37, pin 12; IC25, pin 12; IC26, pin 12; IC27, pin 12; IC28, pin 12)
Outputs not correct
Check GATES (A003, IC38) 1st decade counter with incorrect output

FIGURE 5-2f. BAND I (20 Hz - 20 MHz) TROUBLESHOOTING TREE (Part 1)

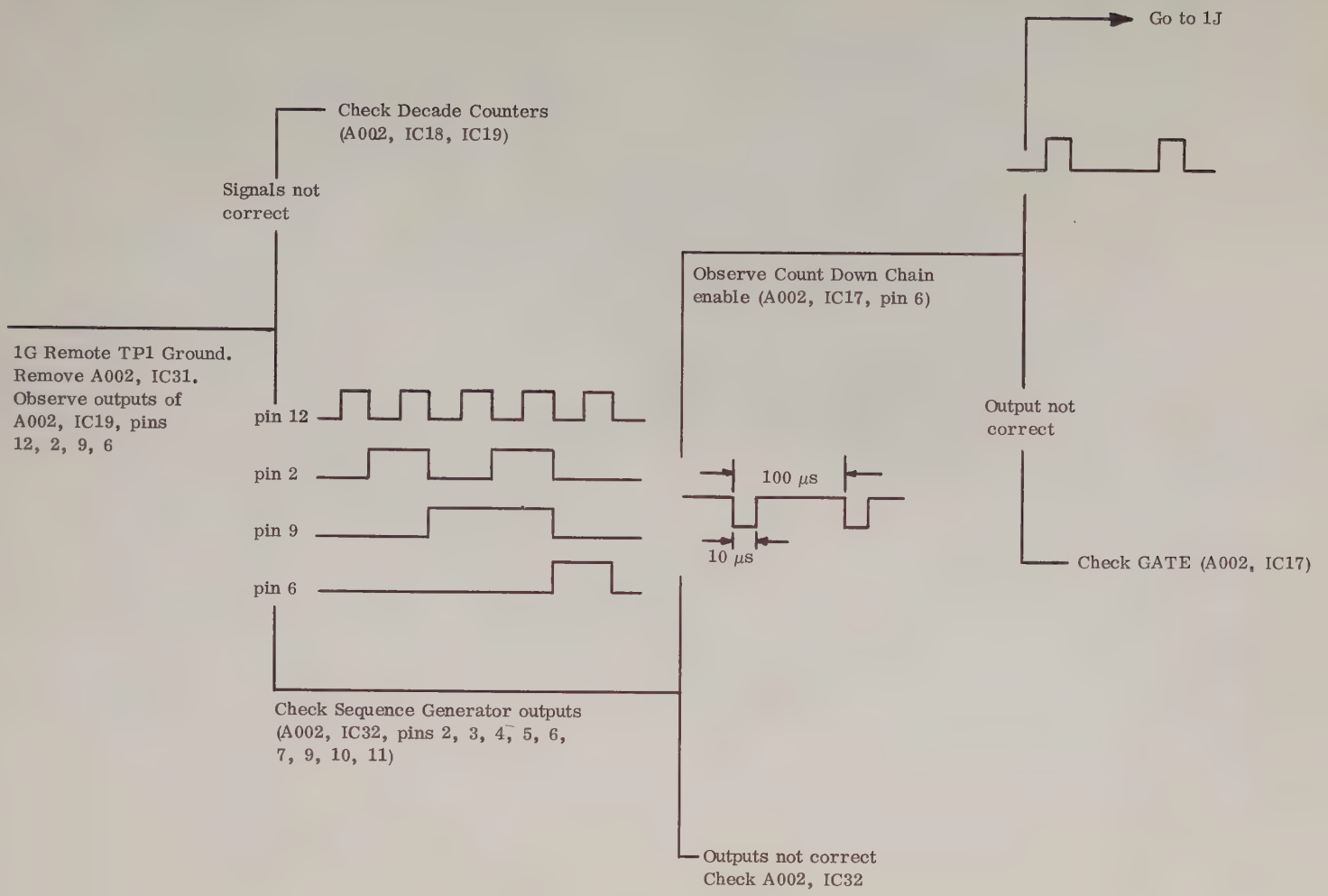
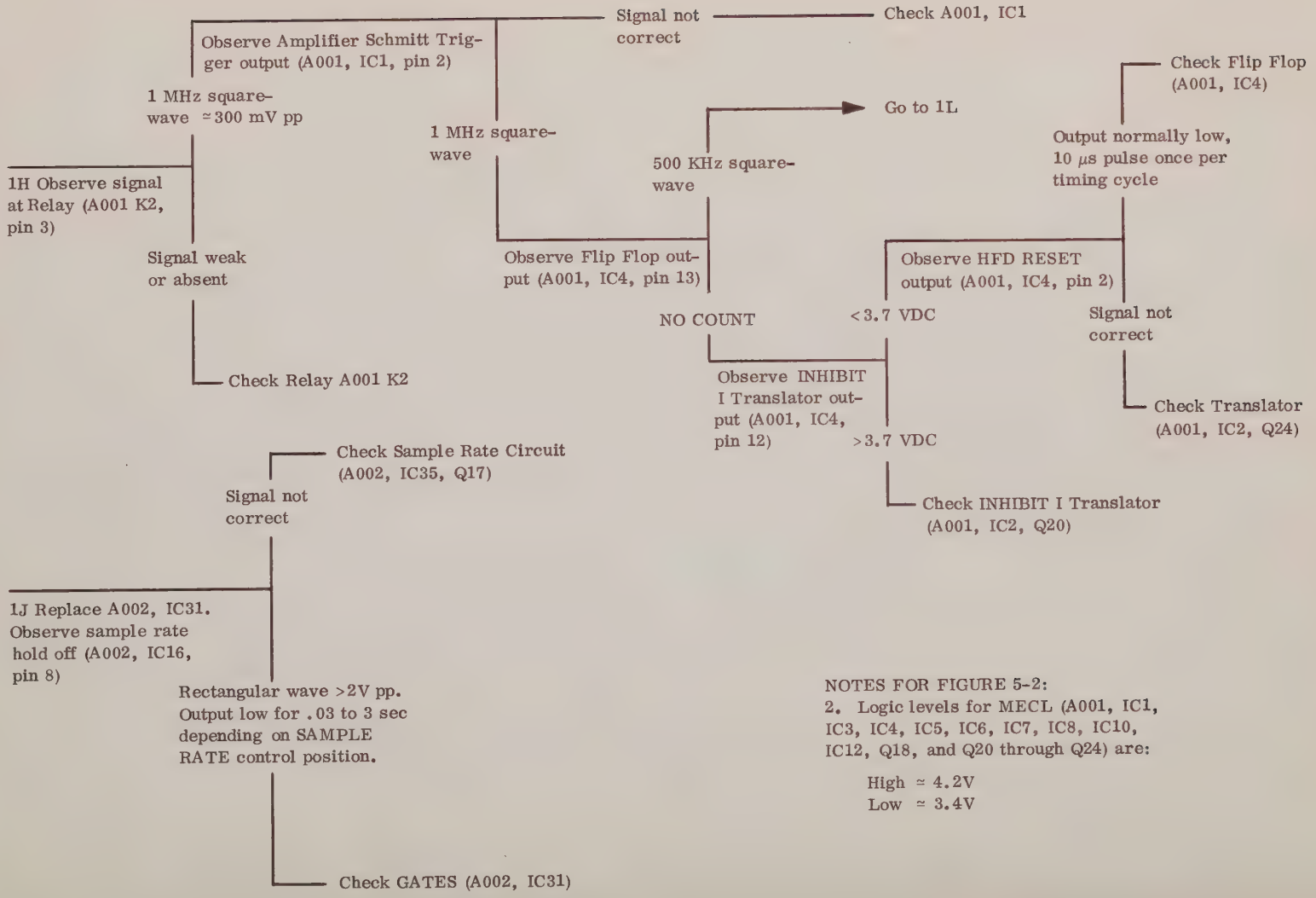


FIGURE 5-2g. BAND I (20 Hz - 20 MHz) TROUBLESHOOTING TREE (Part 1)



NOTES FOR FIGURE 5-2:

2. Logic levels for MECL (A001, IC1, IC3, IC4, IC5, IC6, IC7, IC8, IC10, IC12, Q18, and Q20 through Q24) are:

   High ≃ 4.2V
   Low ≃ 3.4V

FIGURE 5-2h. BAND I (20 Hz - 20 MHz) TROUBLESHOOTING TREE (Part 1)

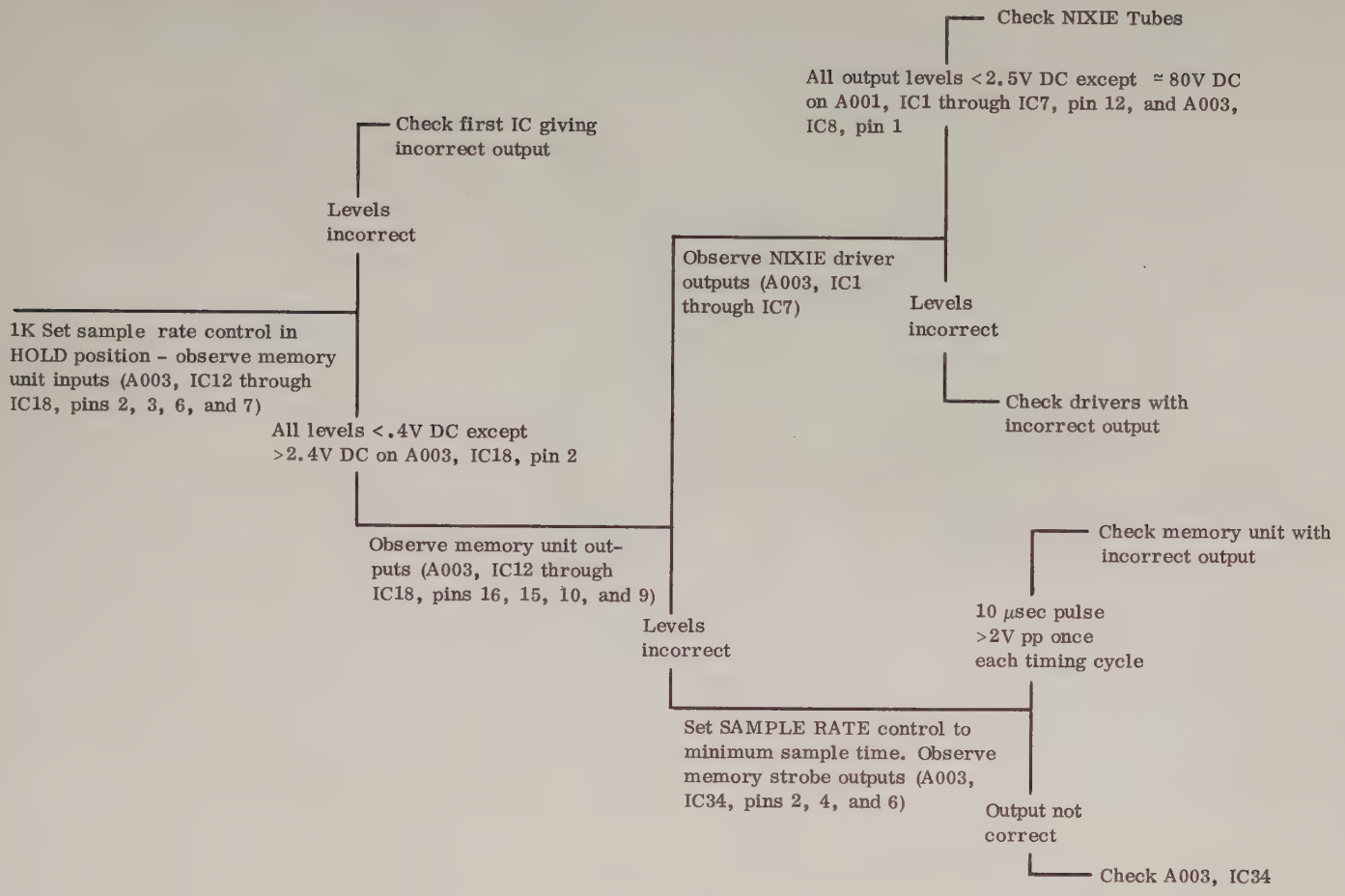

Check NIXIE Tubes
All output levels < 2.5V DC except ≃ 80V DC on A001, IC1 through IC7, pin 12, and A003, IC8, pin 1
Check first IC giving incorrect output
Levels incorrect
Observe NIXIE driver outputs (A003, IC1 through IC7)
Levels incorrect
Check drivers with incorrect output
1K Set sample rate control in HOLD position - observe memory unit inputs (A003, IC12 through IC18, pins 2, 3, 6, and 7)
All levels <.4V DC except >2.4V DC on A003, IC18, pin 2
Observe memory unit outputs (A003, IC12 through IC18, pins 16, 15, 10, and 9)
Check memory unit with incorrect output
10 μsec pulse >2V pp once each timing cycle
Levels incorrect
Set SAMPLE RATE control to minimum sample time. Observe memory strobe outputs (A003, IC34, pins 2, 4, and 6)
Output not correct
Check A003, IC34

FIGURE 5-2i. BAND I (20 Hz - 20 MHz) TROUBLESHOOTING TREE (Part 1)

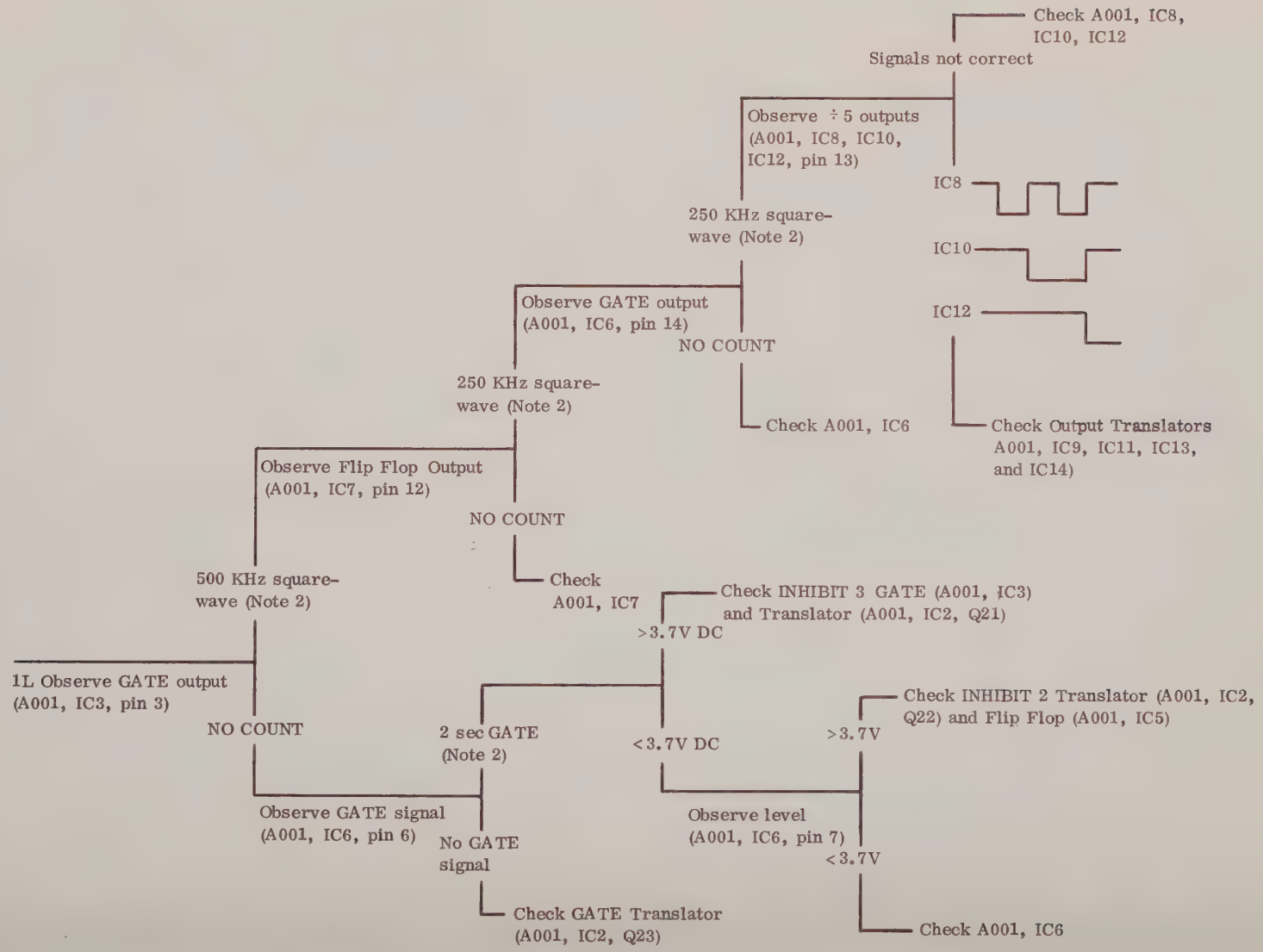

Check A001, IC8, IC10, IC12
Signals not correct
Observe ÷ 5 outputs (A001, IC8, IC10, IC12, pin 13)
IC8
250 KHz square-wave (Note 2)
IC10
Observe GATE output (A001, IC6, pin 14)
IC12
NO COUNT
250 KHz square-wave (Note 2)
Check A001, IC6
Check Output Translators A001, IC9, IC11, IC13, and IC14)
Observe Flip Flop Output (A001, IC7, pin 12)
NO COUNT
500 KHz square-wave (Note 2)
Check A001, IC7
Check INHIBIT 3 GATE (A001, IC3) and Translator (A001, IC2, Q21)
>3.7V DC
1L Observe GATE output (A001, IC3, pin 3)
Check INHIBIT 2 Translator (A001, IC2, Q22) and Flip Flop (A001, IC5)
NO COUNT
2 sec GATE (Note 2)
<3.7V DC
>3.7V
Observe GATE signal (A001, IC6, pin 6)
No GATE signal
Observe level (A001, IC6, pin 7)
<3.7V
Check GATE Translator (A001, IC2, Q23)
Check A001, IC6

FIGURE 5-2j. BAND I (20 Hz - 20 MHz) TROUBLESHOOTING TREE (Part 1)

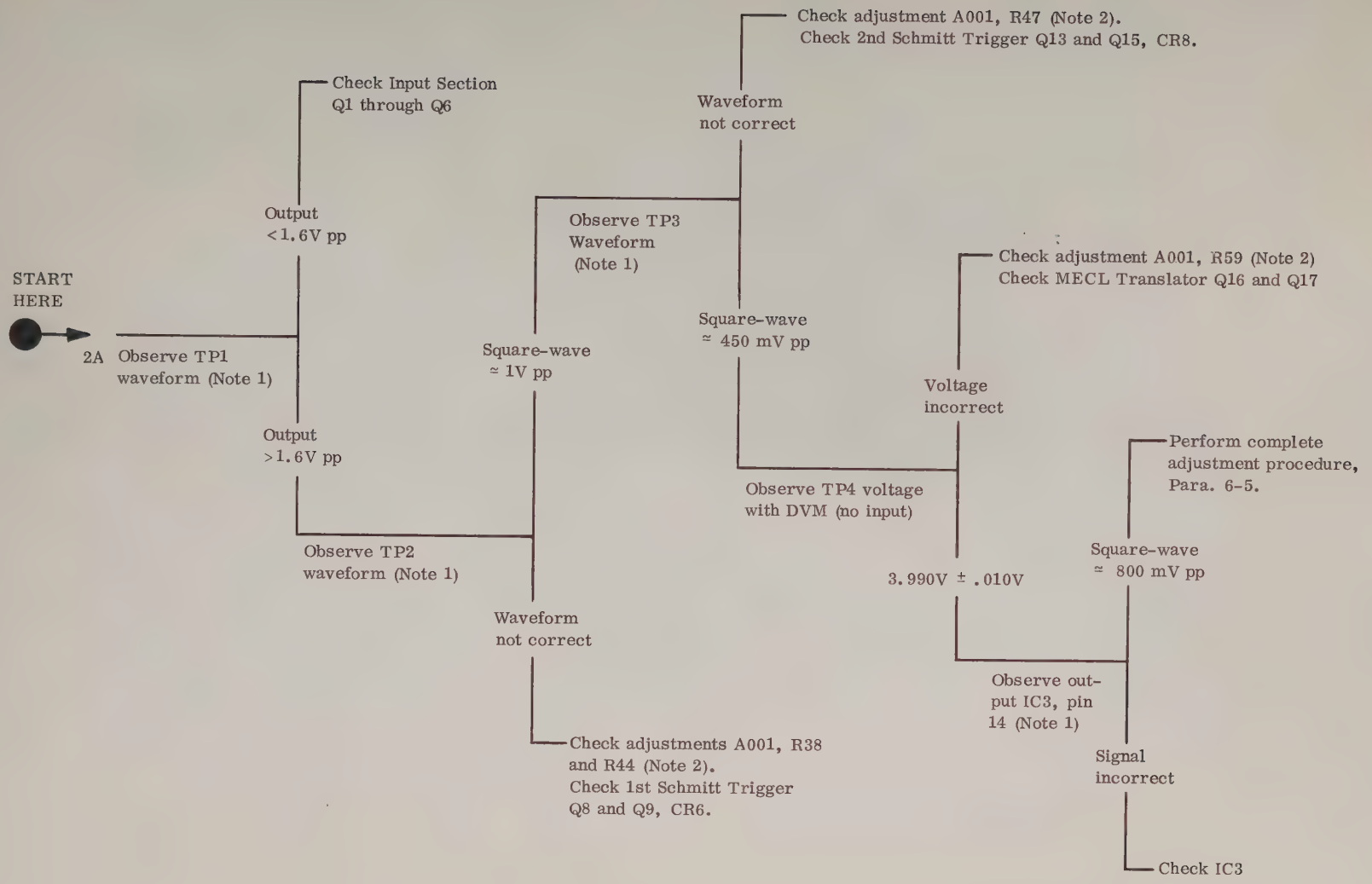
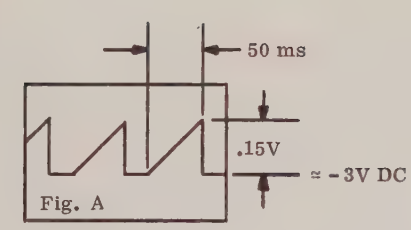
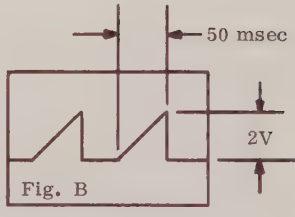

START HERE
2A Observe TP1 waveform (Note 1)
Output <1.6V pp
Check Input Section Q1 through Q6
Output >1.6V pp
Observe TP2 waveform (Note 1)
Square-wave ≃ 1V pp
Observe TP3 Waveform (Note 1)
Waveform not correct
Check adjustments A001, R38 and R44 (Note 2). Check 1st Schmitt Trigger Q8 and Q9, CR6.
Waveform not correct
Check adjustment A001, R47 (Note 2). Check 2nd Schmitt Trigger Q13 and Q15, CR8.
Square-wave ≃ 450 mV pp
Observe TP4 voltage with DVM (no input)
Voltage incorrect
Check adjustment A001, R59 (Note 2) Check MECL Translator Q16 and Q17
3.990V ± .010V
Observe output IC3, pin 14 (Note 1)
Square-wave ≃ 800 mV pp
Perform complete adjustment procedure, Para. 6-5.
Signal incorrect
Check IC3

FIGURE 5-3. BAND I (1 MHz - 210 MHz) TROUBLESHOOTING TREE (Part 2)





START HERE

3A

Check test for proper operation
Check Band I for proper operation
Check range switch setting
Check power of input signal

Check sweep start command Converter Control Board A101 connector, pin 13 (Note 1)

Voltage >2.4V DC (start o.k.)

Voltage <2.4V DC (no start)

Check start threshold circuit A101, R121 setting and detector CR1 of Mixer/Video Amplifier A107 (recalibrate start level). Check IC18 and Q42.

Check sweep output of D/A converter (A001, TP1-12 (see Fig. A)

No sweep signal

Check D/A converter on Converter Control Board A101 (recalibrate sweep)

Sweep as Fig. A

Check YIG sweep current (A001, TP3-3) (Notes 1,2,3)

Go to 3B

NOTES FOR FIGURE 5-4:

1. Test requires proper input signal.
2. Inhibit stop signal by grounding TP3-9 Converter Control Board A101.
3. Use reset pulse to trigger scope (A101, TP1-10).
4. Use delayed sweep on scope.
5. Use DVM with high input impedance (≥10 megohms).

FIGURE 5-4a. BAND II (210 MHz - 1.2 GHz) TROUBLESHOOTING TREE

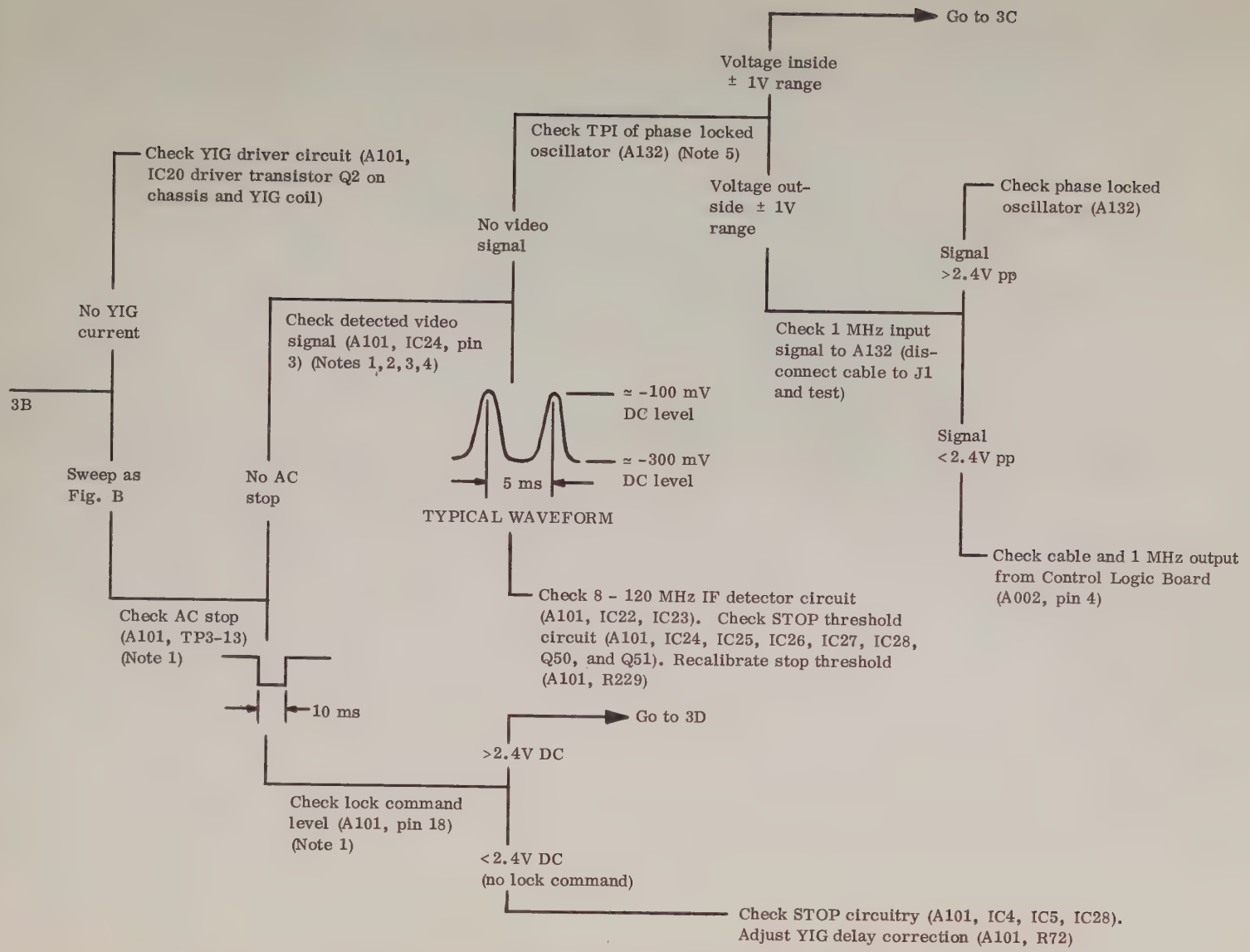

Go to 3C
Voltage inside ± 1V range
Check TPI of phase locked oscillator (A132) (Note 5)
Check YIG driver circuit (A101, IC20 driver transistor Q2 on chassis and YIG coil)
Voltage outside ± 1V range
Check phase locked oscillator (A132)
No video signal
Signal >2.4V pp
No YIG current
Check detected video signal (A101, IC24, pin 3) (Notes 1,2,3,4)
Check 1 MHz input signal to A132 (disconnect cable to J1 and test)
3B
≃ -100 mV DC level
≃ -300 mV DC level
5 ms
Signal <2.4V pp
Sweep as Fig. B
No AC stop
TYPICAL WAVEFORM
Check cable and 1 MHz output from Control Logic Board (A002, pin 4)
Check 8 - 120 MHz IF detector circuit (A101, IC22, IC23). Check STOP threshold circuit (A101, IC24, IC25, IC26, IC27, IC28, Q50, and Q51). Recalibrate stop threshold (A101, R229)
Check AC stop (A101, TP3-13) (Note 1)
10 ms
Go to 3D
>2.4V DC
Check lock command level (A101, pin 18) (Note 1)
<2.4V DC (no lock command)
Check STOP circuitry (A101, IC4, IC5, IC28). Adjust YIG delay correction (A101, R72)

FIGURE 5-4b. BAND II (210 MHz - 1.2 GHz) TROUBLESHOOTING TREE

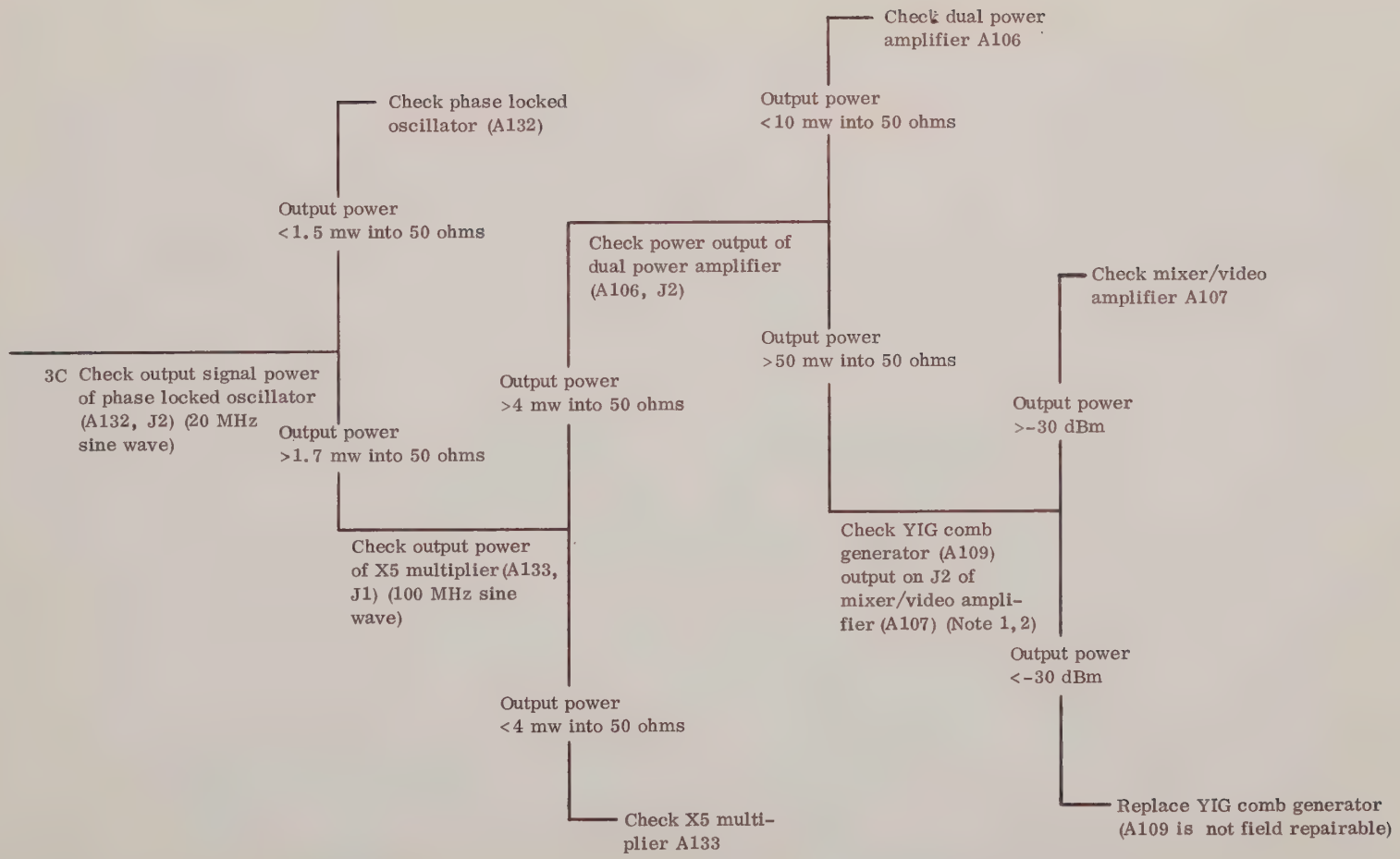


FIGURE 5-4c. BAND II (210 MHz - 1.2 GHz) TROUBLESHOOTING TREE

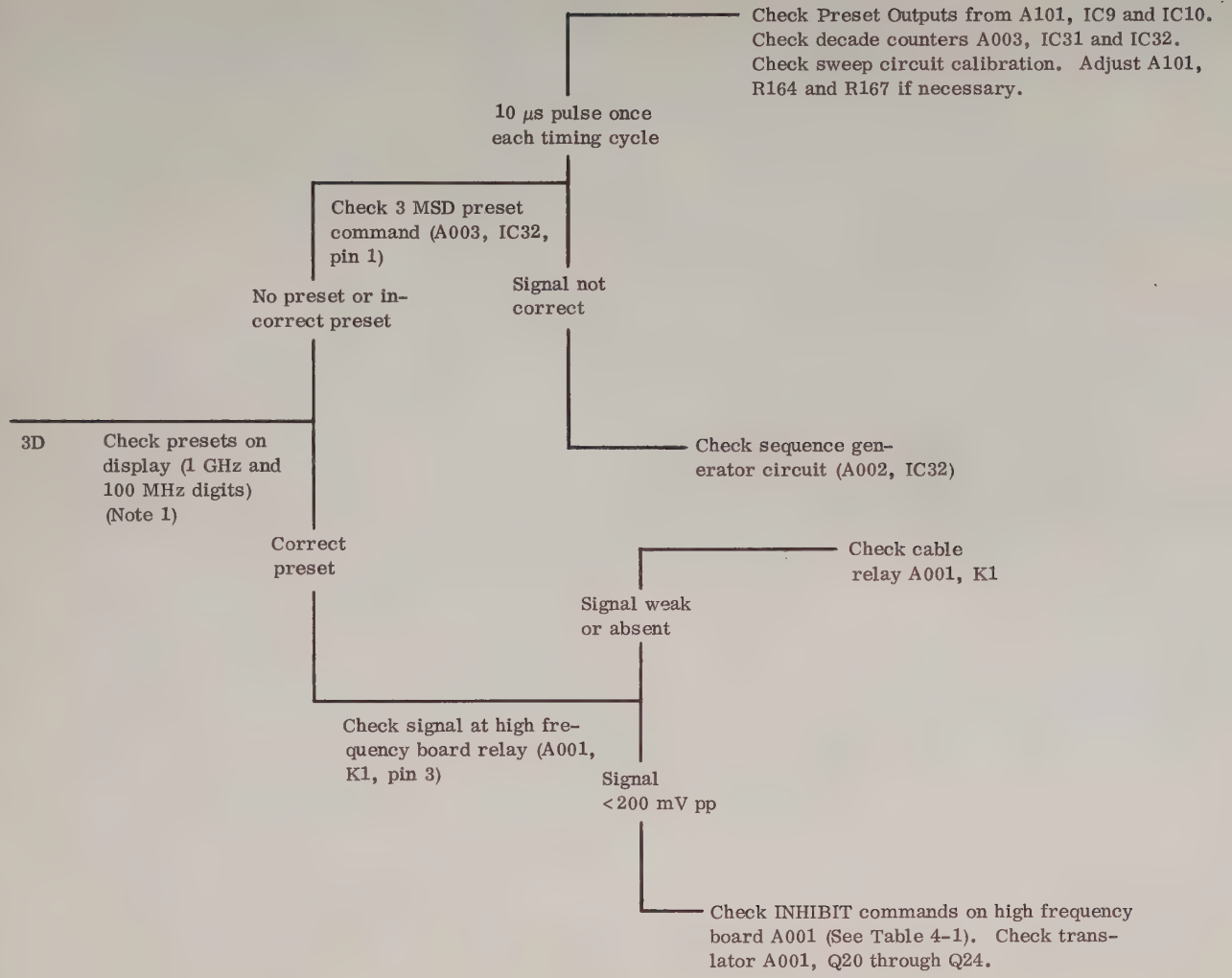
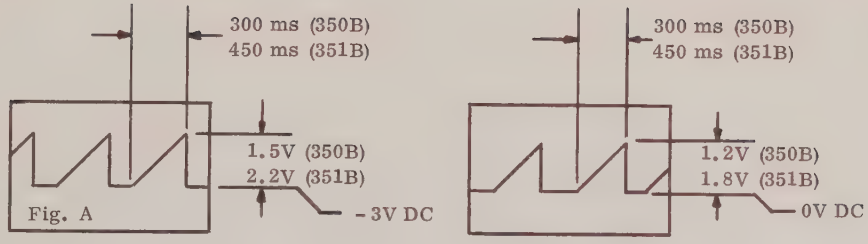
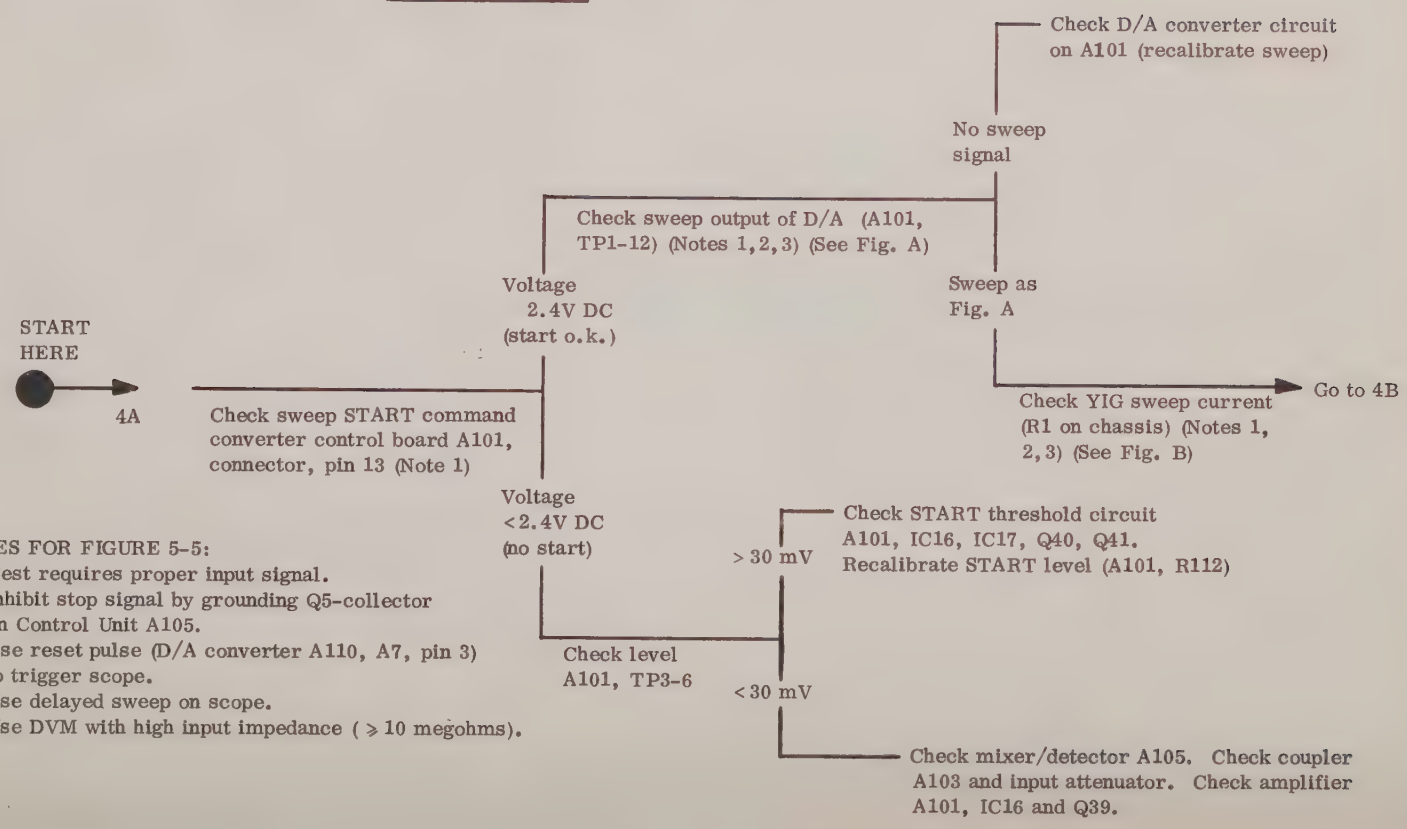

Check Preset Outputs from A101, IC9 and IC10. Check decade counters A003, IC31 and IC32. Check sweep circuit calibration. Adjust A101, R164 and R167 if necessary.
10 μs pulse once each timing cycle
Check 3 MSD preset command (A003, IC32, pin 1)
No preset or incorrect preset
Signal not correct
Check sequence generator circuit (A002, IC32)
3D
Check presets on display (1 GHz and 100 MHz digits) (Note 1)
Correct preset
Check cable relay A001, K1
Signal weak or absent
Check signal at high frequency board relay (A001, K1, pin 3)
Signal <200 mV pp
Check INHIBIT commands on high frequency board A001 (See Table 4-1). Check translator A001, Q20 through Q24.

FIGURE 5-4d. BAND II (210 MHz - 1.2 GHz) TROUBLESHOOTING TREE




Check D/A converter circuit on A101 (recalibrate sweep)
No sweep signal
Check sweep output of D/A (A101, TP1-12) (Notes 1,2,3) (See Fig. A)
Voltage 2.4V DC (start o.k.)
Sweep as Fig. A
START HERE
4A
Check sweep START command converter control board A101, connector, pin 13 (Note 1)
Check YIG sweep current (R1 on chassis) (Notes 1, 2, 3) (See Fig. B)
Go to 4B
Voltage <2.4V DC (no start)
> 30 mV
Check START threshold circuit A101, IC16, IC17, Q40, Q41. Recalibrate START level (A101, R112)
Check level A101, TP3-6
< 30 mV
Check mixer/detector A105. Check coupler A103 and input attenuator. Check amplifier A101, IC16 and Q39.

NOTES FOR FIGURE 5-5:

1. Test requires proper input signal.
2. Inhibit stop signal by grounding Q5-collector on Control Unit A105.
3. Use reset pulse (D/A converter A110, A7, pin 3) to trigger scope.
4. Use delayed sweep on scope.
5. Use DVM with high input impedance ($\geq$ 10 megohms).

FIGURE 5-5a. BAND III (1.2 GHz - 12.4/18 GHz) TROUBLESHOOTING TREE

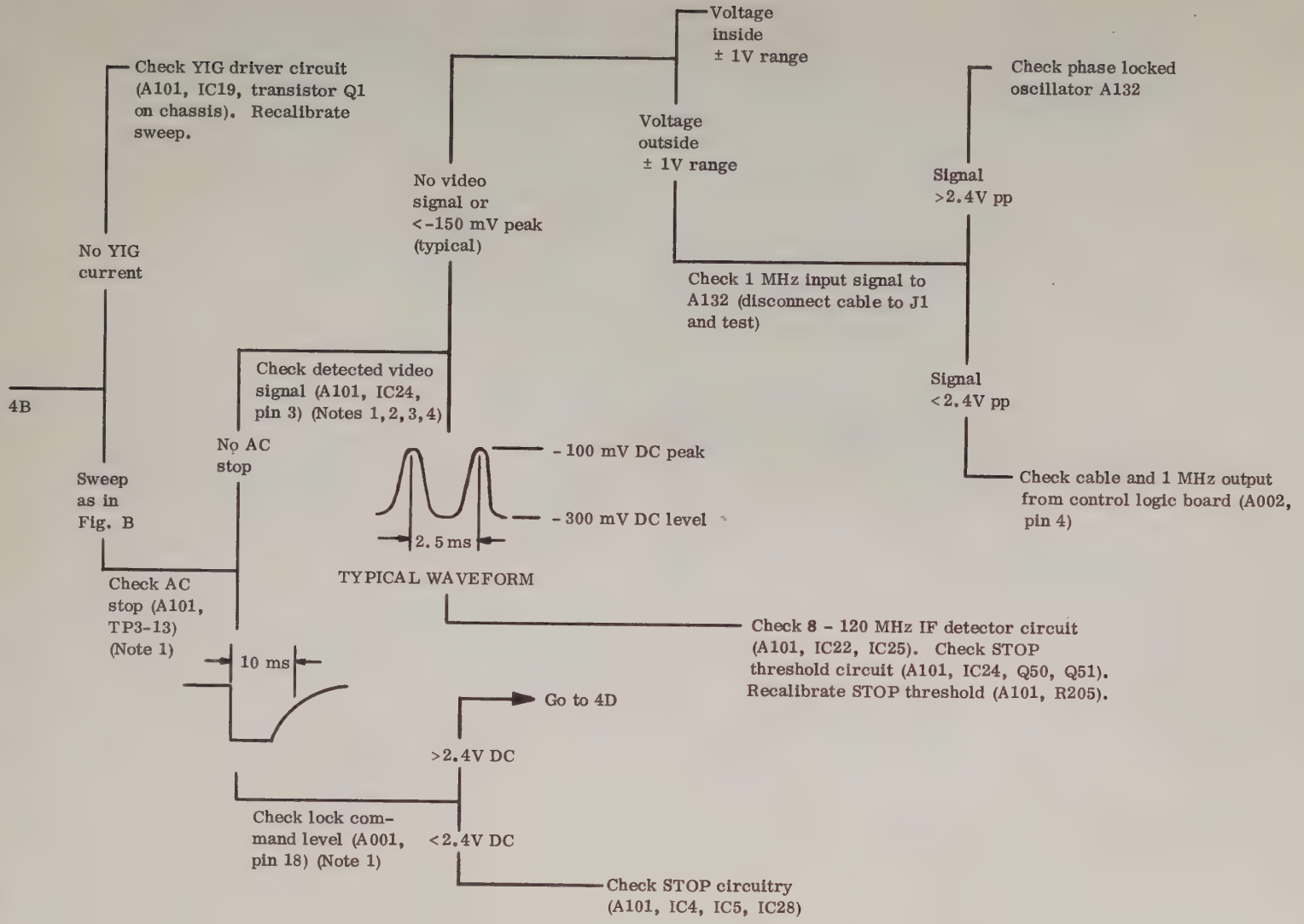

Voltage inside ± 1V range
Check YIG driver circuit (A101, IC19, transistor Q1 on chassis). Recalibrate sweep.
Voltage outside ± 1V range
Check phase locked oscillator A132
No video signal or <-150 mV peak (typical)
Signal >2.4V pp
No YIG current
Check 1 MHz input signal to A132 (disconnect cable to J1 and test)
Check detected video signal (A101, IC24, pin 3) (Notes 1, 2, 3, 4)
Signal <2.4V pp
4B
No AC stop
- 100 mV DC peak
- 300 mV DC level
Check cable and 1 MHz output from control logic board (A002, pin 4)
Sweep as in Fig. B
2.5 ms
TYPICAL WAVEFORM
Check AC stop (A101, TP3-13) (Note 1)
Check 8 - 120 MHz IF detector circuit (A101, IC22, IC25). Check STOP threshold circuit (A101, IC24, Q50, Q51). Recalibrate STOP threshold (A101, R205).
10 ms
Go to 4D
>2.4V DC
Check lock command level (A001, pin 18) (Note 1)
<2.4V DC
Check STOP circuitry (A101, IC4, IC5, IC28)

FIGURE 5-5b. BAND III (1.2 GHz - 12.4/18 GHz) TROUBLESHOOTING TREE

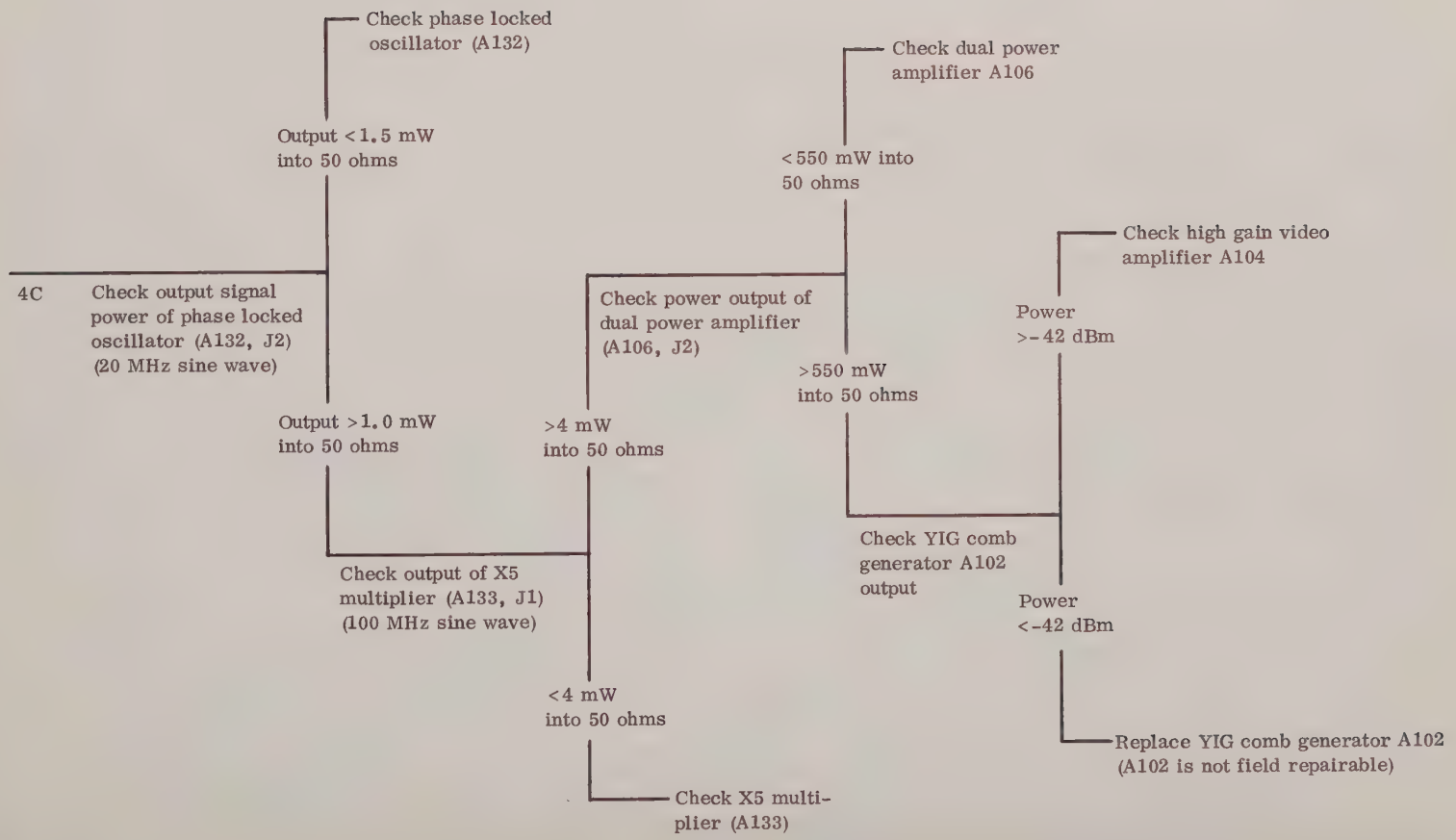


FIGURE 5-5c. BAND III (1.2 GHz - 12.4/18 GHz) TROUBLESHOOTING TREE

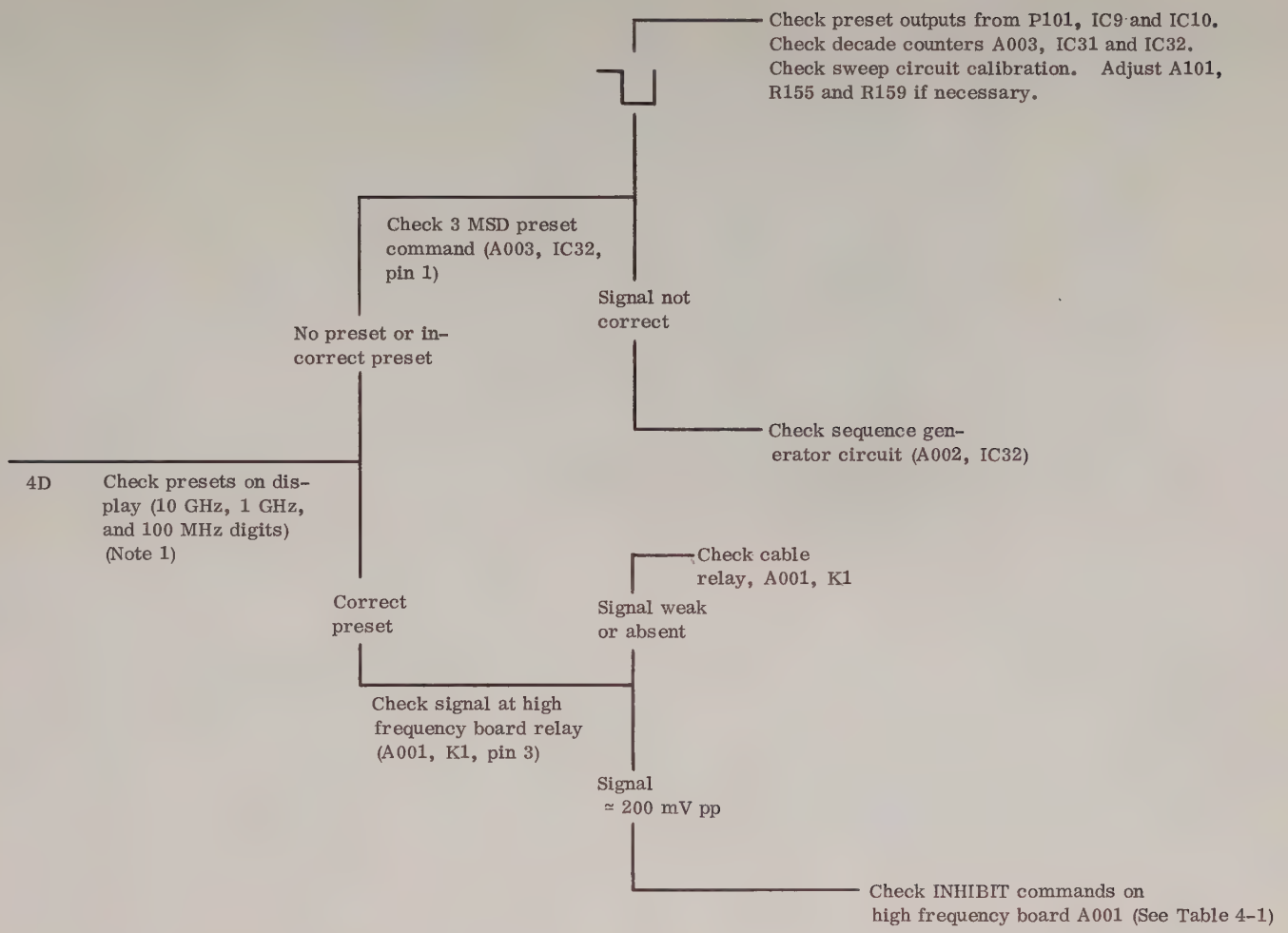

Check preset outputs from P101, IC9 and IC10.
Check decade counters A003, IC31 and IC32.
Check sweep circuit calibration. Adjust A101, R155 and R159 if necessary.
Check 3 MSD preset command (A003, IC32, pin 1)
Signal not correct
No preset or incorrect preset
Check sequence generator circuit (A002, IC32)
4D
Check presets on display (10 GHz, 1 GHz, and 100 MHz digits) (Note 1)
Check cable relay, A001, K1
Signal weak or absent
Correct preset
Check signal at high frequency board relay (A001, K1, pin 3)
Signal ≃ 200 mV pp
Check INHIBIT commands on high frequency board A001 (See Table 4-1)

FIGURE 5-5d. BAND III (1.2 GHz - 12.4/18 GHz) TROUBLESHOOTING TREE

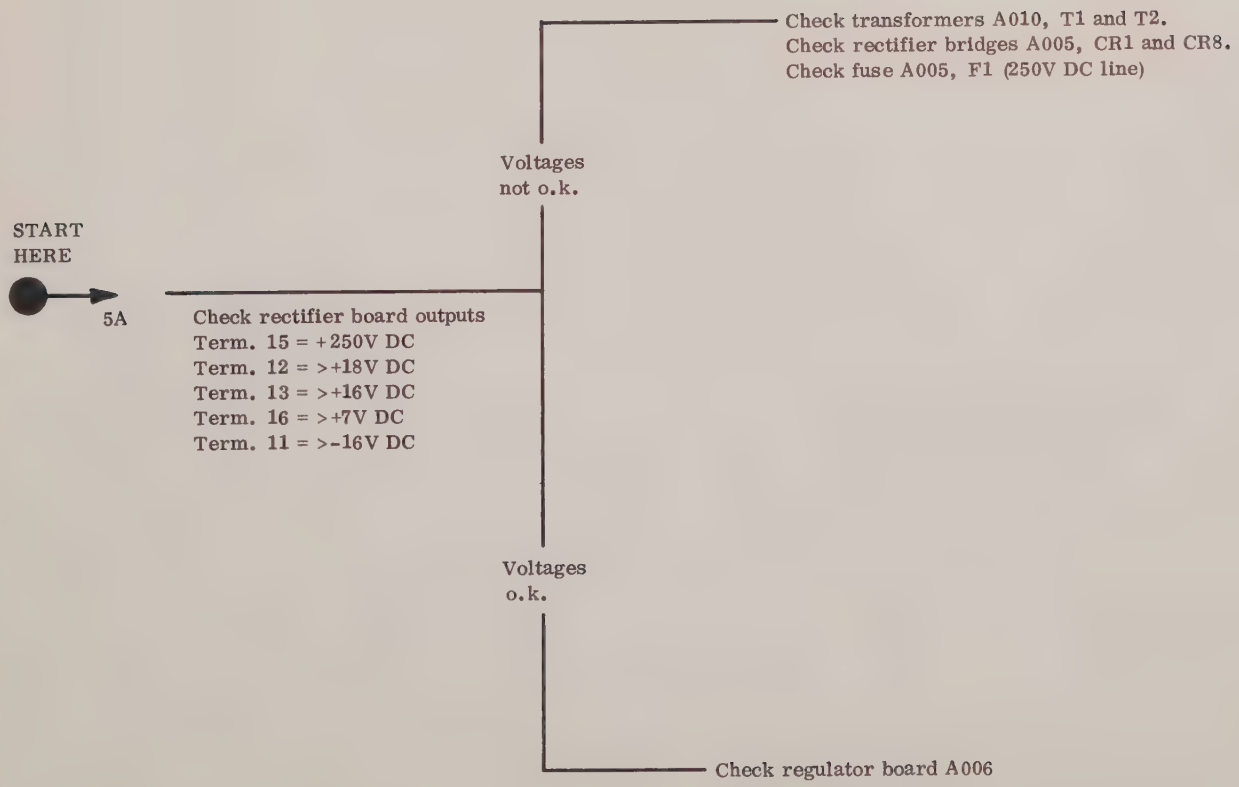


FIGURE 5-6. POWER SUPPLY TROUBLESHOOTING TREE

SECTION VI

ADJUSTMENTS

6-1. GENERAL

6-2. This section describes the procedures to be followed in order to correctly set up the 350B/351B Autohet Counter. In general, adjustments should be made only if the instrument is not operating within specification or following replacement of components. Test equipment required is specified in Table 7-1.

6-3. POWER SUPPLY ADJUSTMENT

6-4. Prior to any power supply adjustments, the instrument should be allowed to warm up for at least 20 minutes. Adjustments are made according to the following procedure:

a. Connect DVM ground directly to Regulator Board (A006, pin 5).

b. Measure +14 V output, A006, pin 2.
Adjust A006R38 until output is +14.000 $^{+.020}_{-.000}$ volts.

c. Measure +12 V output, A006, pin 12.
Adjust A006R21 until output is +12.000 $^{+.020}_{-.000}$ volts.

d. Measure -12 V output, A006, pin 8.
Adjust A006R23 until output is -12.000 $^{+.000}_{-.020}$ volts.

e. Measure +5 V output, A006, pin 13.
Adjust A006R7 until output is +5.000 $^{+.020}_{-.000}$ volts.

6-5. BAND I ADJUSTMENT

a. Adjust 20 Hz to 20 MHz input.

(1) Set BAND SELECT switch to Band I.

(2) Set Band I Mode switch to 20 Hz - 20 MHz.

(3) Apply a 20 Hz signal at 100 mV RMS at input.

(4) Observe waveform at A001TP-5 with oscilloscope. If negative going spikes appear at the beginning of the positive half of the square wave, adjust A001R73 until spikes disappear.

(5) Apply a 20 MHz signal at 100 mV RMS to input. If reading is incorrect, adjust A001R73.

(6) Perform Performance Test, paragraph 7-5.

b. Adjust 1 MHz - 210 MHz input.

(1) Set BAND SELECT switch to Band I.

(2) Set Band I Mode switch to 1 MHz - 210 MHz.

(3) Apply a 1 MHz signal at -13 dBm to input.

(4) Connect oscilloscope probe to A001TP-1. Check amplitude for 1600 mV P-P minimum.

(5) Connect probe to A001TP-2. Adjust A001R38 for maximum symmetry of square wave.

(6) Adjust A001R44 for maximum amplitude of square wave, 1 V P-P typical.

(7) Connect probe to A001TP-3. Adjust A001R47 for approximate center of good square wave shape; typical amplitude is 450 mV P-P.

(8) Disconnect 1 MHz input signal and oscilloscope probe. Connect DVM to A001TP-4. Adjust A001R59 for 3.990 V $\pm$ .010 V. Allow several minutes for stabilization after removing signal.

(9) Apply 1 MHz at -13 dBm to input. A good count should be obtained (correct reading without rambling numbers).

(10) Apply a 210 MHz signal at -13 dBm to input. If an incorrect reading is obtained, adjust A001R47 for maximum frequency on display. Then adjust A001R44 for maximum frequency on display. A good reading should be obtained.

(11) Apply a 1 MHz signal at -13 dBm and check for good reading.

(12) Disconnect input signal and check for rambling numbers on display. If so, adjust A001R38 slightly until all zeros are obtained. Recheck count at 1 MHz at -13 dBm and at 210 MHz at -13 dBm.

(13) Perform Performance Test, paragraph 7-9.

6-6. BAND II ADJUSTMENT

a. Adjust START threshold.

(1) Set BAND SELECT switch to Band II.

(2) Connect DVM to pin 13 on Converter Control Board A101.

(3) Apply a 210 MHz signal at -10 dBm to Band II input.

(4) Adjust A101R143 until voltage just goes high (>2.4 Vdc). Voltage should go low (<.4 Vdc) when signal is removed.

b. Adjust IF Band Circuit.

(1) Disconnect cable from Mixer/Video Amplifier output (A107J3).

(2) Connect sweep oscillator to cable and apply a leveled swept signal from 0 to 130 MHz at -13 dBm.

(3) Observe detected output with oscilloscope at A101IC24, pin 3. Use sweep signal from oscilloscope to drive the external horizontal input of the oscilloscope.

(4) Adjust A101C45 for flattest response out to 120 MHz. Disconnect oscilloscope.

(5) Using a dual-channel oscilloscope, connect Channel A input to A101IC23, pin 3. Connect Channel B input to A101IC23, pin 2.

(6) Set oscilloscope sensitivity to 20 mV/cm (both channels), A + B, with B Channel input inverted.

(7) Adjust A101R197 such that switching spike at 120 MHz occurs about half-way down the slope of the filter response. See Figure 6-1.

(8) Increase signal level to -10 dBm and tune slowly up to 120 MHz. Adjust A101C51 so that voltage on A101IC23, pin 6 just goes to low (≃ -10 Vdc) at 120 MHz. After adjustment, always tune frequency to less than 110 MHz and increase slowly to 120 MHz to observe switching point. After switching, low voltage should not switch high until signal frequency is reduced to approximately 115 MHz.

c. Adjust RESET Threshold.

(1) Connect DVM to A101TP3-8.

(2) Apply a 50 MHz signal at -10 dBm to cable.

(3) Adjust A101R218 until voltage just goes high (>2.4 Vdc).

d. Adjust STOP Threshold.

(1) Connect DVM to A101IC24, pin 3.

(2) Apply a 50 MHz signal at -4 dBm to cable. Record voltage at A101IC24, pin 3.

(3) Ground A101IC26, pin 9.

(4) Using dual-channel oscilloscope, set Channel A input to 50 mV/cm. Ground oscilloscope input, and set base line of trace on top line of graticule.

(5) Connect oscilloscope Channel A input to A101IC23, pin 3. Note voltage level of signal. (Typical level with no input to counter will be -300 mVdc.

(6) Connect oscilloscope Channel B input to A101IC27, pin 8. Set sensitivity to 1 v/cm. Set base line of Channel B trace to voltage level measured in Step (2).

(7) Trigger oscilloscope from A101TP1-10.

(8) Apply signal to counter at proper level and frequency to Band II input.

(9) Adjust A101R203 such that point where positive-going signal on Channel A intersects the negative-going signal on Channel B at the voltage level measured in Step (2). See Figure 6-2.

(10) Reconnect cable to Mixer/Video Amplifier.

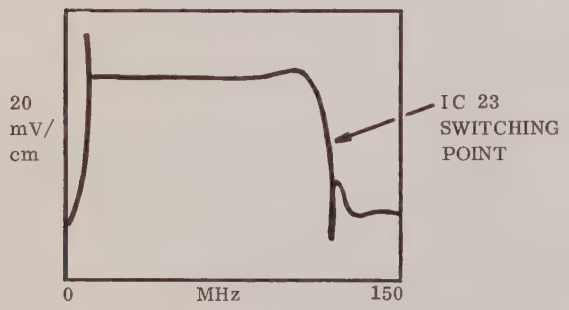


FIGURE 6-1.
SWITCHING POINT ADJUSTMENT

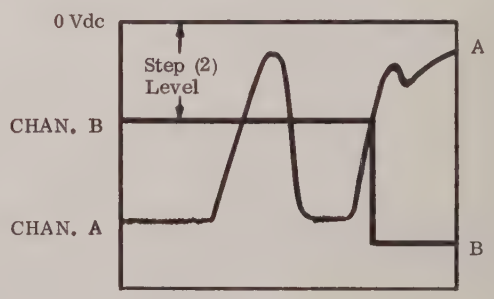


FIGURE 6-2.
LEVEL ADJUSTMENT

e. Adjust YIG Delay Correction.

(1) Inhibit LOCK command by grounding A101IC26, pin 9.

(2) Apply signal of 210 MHz at -7 dBm to Band II input.

(3) Observe signal at A101IC24, pin 3 with oscilloscope. Use delayed sweep and trigger oscilloscope from reset pulse (A101TP1-10).

(4) Adjust A101R72 until the end of the pulse is the same voltage as the voltage on the initial peak. See Figure 6-3 for a typical pulse shape.

(5) Tune input signal slowly from 210 MHz to 1200 MHz while observing the pulse. If at any point in the band the final voltage of the pulse falls below 80% of the initial peak, readjust A101R72. Repeat this procedure until the pulse final voltage is nowhere less than 80% of the initial peak. Remove A101IC26, pin 9 ground.

FIGURE 6-3.
YIG DELAY CORRECTION

f. Adjust Sweep Circuit.

(1) Apply a 350 MHz signal at -7 dBm to Band II input.

(2) Adjust A101R164 (push RESET button after each adjustment) until the following conditions are met:

(a) 100 MHz digit on display reads "3".

(b) Outputs of first D/A Counter (A101IC8) indicate 40, 50, or 60 MHz. See Table 6-1.

(3) Apply an 1150 MHz signal at -7 dBm to Band II input.

(4) Adjust A101R167 (push RESET button after each adjustment) until the following conditions are met:

(a) 1 GHz and 100 MHz digits on display read "11".

(b) Outputs of first D/A Counter (A101IC8) indicate 40, 50, or 60 MHz. See Table 6-1.

(5) Repeat steps (1) through (4) until no further adjustments are necessary.

g. Perform Performance Test, paragraph 7-10.

TABLE 6-1 - D/A COUNTER TRUTH TABLE

Frequency	TP1-5	TP1-8	TP1-3	TP1-9
10 MHz	1	0	0	0
20 MHz	0	1	0	0
30 MHz	1	1	0	0
40 MHz	0	0	1	0
50 MHz	1	0	1	0
60 MHz	0	1	1	0
70 MHz	1	1	1	0
80 MHz	0	0	0	1
90 MHz	1	0	0	1
100 MHz	0	0	0	0

6-7. BAND III ADJUSTMENT

a. Perform Band II adjustments. (Several adjustments are common to both Band II and Band III. The following steps assume that all adjustments for Band II have already been made.)

b. Set BAND SELECT switch to Band III.

c. Adjust YIG Power Level.

(1) Disconnect Mixer/Detector (A105) from Coupler (A103). (Do not rotate body of A105 when disconnecting or reconnecting. Internal damage may result.)

(2) Connect calibrated detector through DC block to the coupler.

(3) Connect the detector output to one of the vertical inputs of oscilloscope. (.1 mV/cm vertical sensitivity). Trigger the oscilloscope from the RESET pulse A101TP1-10.

(4) Ground A101TP3-12 to generate a continuous START command.

(5) Observe the voltage at A101R110, R117, and R132. Full voltage (≃ 11.8 Vdc) appears during the entire sweep, only if A101R104, R105, R111, R112, R126, and R127 are turned fully counter-clockwise.

(6) Go to A101TP2-3. With the detector output and TP2-3 simultaneously displayed on the oscilloscope, adjust A101R104 and R105 so that the output at TP2-3 goes high when the first peak of the detector output envelope exceeds -28 dBm and remains high until the envelope drops below -28 dBm.

(7) Adjust A101R110 until the highest output in the first peak is -28 dBm.

(8) If a second peak occurs greater than -28 dBm, repeat steps (6) and (7) for the third peak using A101R111, R112, and R117, while monitoring A101TP2-1.

(9) If a third peak occurs greater than -28 dBm, repeat steps (6) and (7) for the third peak using A101R126, R127, and R132, while monitoring A101TP2-9.

Note: During the above procedure, do not attenuate lines more than necessary or more lines than necessary. No line from 1.1 to 9.5 GHz should be less than -40 dBm. It is not necessary to attenuate lines at frequencies above 7 GHz for the 350B or 9.5 GHz for the 351B. If necessary for optimum flatness, the various frequency ranges over which the output is reduced may overlap.

(10) Replace Mixer/Detector A105 on Coupler (A103) being careful not to rotate the unit while tightening connector. Remove ground from A101TP3-13.

d. Adjust START Threshold.

(1) Connect DVM to Pin 13 on Converter Control Board (A101).

(2) Apply a 7 GHz signal at -8 dBm to Band III input.

(3) Adjust A101R251 until voltage just goes high (>2.4 Vdc). Voltage should go low (<.4 Vdc) when signal is removed.

(4) Check all frequencies from 1.2 to 12.4 (or 18) GHz at -8 dBm input for START command. Readjust A101R112 as required.

e. Adjust STOP Threshold.

(1) Connect DVM to A101IC24, pin 3.

(2) Disconnect cable from High Gain Video Amplifier (A104, J1).

(3) Ground A101IC26, pin 9.

(4) Using dual-channel oscilloscope, set Channel A input to 50 mV/cm. Ground oscilloscope input, and set base line of trace on top line of graticule.

(5) Connect oscilloscope Channel A input to A101IC23, pin 3. Note voltage level of signal. (Typical level with no input to counter will be -300 mVdc.)

(6) Connect oscilloscope Channel B input to A101IC27, pin 8. Set sensitivity to 1 v/cm. Set base line of Channel B trace to voltage level measured in Step (2).

(7) Trigger oscilloscope from A101TP1-10.

(8) Apply signal to counter at proper level and frequency to Band III input.

(9) Adjust A101R217 such that point where positive-going signal on Channel A intersects the negative-going signal on Channel B at the voltage level measured in Step (2). See Figure 6-2.

(10) Reconnect cable to Mixer/Video Amplifier.

f. Adjust Sweep Circuit.

(1) Apply a 1550 MHz signal at -7 dBm to Band III input.

(2) Adjust A101R155 (push RESET button after each adjustment) until the following conditions are met:

(a) 1 GHz and 100 MHz digits on display read "15".

(b) Outputs of first D/A Counter (A101IC8) indicate 40, 50, or 60 MHz. See Table 6-1.

(3) Apply a 12.050 GHz signal at -7 dBm to Band III input.

(4) Adjust A101R159 (push RESET button after each adjustment) until the following conditions are met:

(a) 10 GHz, 1 GHz and 100 MHz digits on display read "120".

(b) Outputs of first D/A Counter (A101IC8) indicate 40, 50, or 60 MHz. See Table 6-1.

(5) Repeat Steps (1) through (4) until no further adjustments are required.

Note: The following steps (6) through (8) apply only to Model 351B.

(6) Apply a 14.050 MHz Signal at -3 dBm to Band III input. Connect DVM to A101TP3-2 and adjust A101R173 until voltage at TP3-2 is zero volts. This is the linearizer breakpoint.

(7) Apply a 17.850 GHz signal at -3 dBm to Band III input. Adjust A101R177 (press RESET button after each adjustment) until the following conditions are met:

(a) 10 GHz, 1 GHz, and 100 MHz digits on display indicate "178".

(b) Outputs of first D/A Counter (A101IC8) indicate 40, 50, or 60 MHz. See Table 6-1.

(8) Check the lock point on all lines from 13.5 to 18 GHz. For all lines, A101IC8 outputs must lock between 20 and 80 MHz (see Table 6-1). If not, readjust A101R173 and R177 until this condition is met.

g. Perform Performance Test, paragraph 7-11.

SECTION VII

PERFORMANCE TESTS

7-1. GENERAL

7-2. The purpose of this section is to enable the user to verify that the instrument meets specifications over the entire frequency range.

7-3. VARIABLE LINE VOLTAGE

7-4. During the performance tests the 350B/351B should be connected to the power source through a variable voltage device so that line voltage may be varied ± 10% from nominal (115 or 230 Vac) to assure proper operation of the counter under various supply conditions.

7-5. RECOMMENDED TEST EQUIPMENT

7-6. See Table 7-1 for recommended test equipment. Other equipment may be used provided that performance is equal to, or better than, that of the recommended equipment.

7-7. Performance Tests

7-8. RANGE AND SENSITIVITY – BAND I (20 Hz to 20 MHz)

a. Set controls as follows:

(1) SAMPLE RATE: Slightly clockwise just past power off detent.

(2) BAND SELECT: Band I (20 Hz to 210 MHz).

(3) MODE SELECT: 20 Hz to 20 MHz.

(4) TIME BASE: INT.

b. Connect test oscillator output to Band I input.

c. Set signal level to 100 mV RMS.

d. Vary signal from 20 Hz to 20 MHz. Counter should display correct input frequency.

7-9. RANGE AND SENSITIVITY – BAND I (1 MHz to 210 MHz)

a. Set controls as follows:

(1) SAMPLE RATE: Slightly clockwise just past power off detent.

(2) BAND SELECT: Band I (20 Hz to 210 MHz).

(3) MODE SELECT: 1 MHz to 210 MHz.

(4) TIME BASE: INT.

b. Connect signal source output to Band I input.

c. Vary signal frequency from 1 MHz to 210 MHz at -13 dBm (50 mV RMS) power level. Counter should display correct input frequency.

7-10. RANGE AND SENSITIVITY – BAND II (210 MHz to 1.2 GHz)

a. Set controls as follows:

(1) SAMPLE RATE: Slightly clockwise just past power off detent.

(2) BAND SELECT: Band II (210 MHz to 1.2 GHz).

(3) TIME BASE: INT.

b. Connect signal source output to Band II input.

c. Vary signal frequency from 210 MHz to 1.20 GHz at -7 dBm (100 mV RMS) power level. Counter should display correct frequency.

7-11. RANGE AND SENSITIVITY – BAND III (1.2 GHz to 12.4 or 18 GHz)

a. Set controls as follows:

(1) SAMPLE RATE: Slightly clockwise just past power off detent.

(2) BAND SELECT: Band III (1.2 to 12.4 GHz or 18 GHz).

(3) TIME BASE: INT.

b. Level signal source at -7 dBm (-3 dBm, 12.4 to 18 GHz).

c. Connect leveled source output to Band III input.

d. Vary signal frequency from 1.2 to 12.4 (or 18) GHz. Counter should display correct reading.

7-12. TIME BASE AGING RATE

a. Place counter in constant temperature environment.

b. Allow counter to warm up for 24 hours or for 72 hours if the counter has been disconnected from AC power for 24 hours or more.

c. Connect 1 MHz rear panel output to input of VLF comparator. (If VLF comparator is not equipped to accept 1 MHz inputs, a divider must be provided.)

d. Determine average frequency over a two-hour interval.

Note: Time interval selected should be during periods of maximum stability of received VLF signal. Avoid periods near sunrise or sunset.

e. Determine average frequency over the same two-hour interval 24 hours later. Counter should remain plugged into the power line during this period to keep time base oven temperature constant.

f. The daily aging rate is the difference between the two readings. This should be less than ± 5 parts in 10^{-9}.

TABLE 7-1. RECOMMENDED TEST EQUIPMENT

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	INSTRUMENT RECOMMENDED
Signal Source	Continuous coverage from 20 Hz to 12.4 (or 18) GHz, with internal leveling or capable of external leveling.	HP 651B (20 Hz to 10 MHz) HP 608E (10 MHz - 480 MHz) HP 8690B Mainframe HP 8699B Plug-in (.1 to 4 GHz) HP 8693B Plug-in (4 to 8 GHz) HP 8694B Plug-in (8 to 12.4 GHz) HP 8695A Plug-in (12.4 to 18 GHz)
Power Meter	Calibrated to 18 GHz.	HP 432A with 8478A Thermistor Mount
Directional Coupler/Detector	Flat response out to 18 GHz.	Narda 3020A (.25 to 1.0 GHz) Coupler Narda 4202B-10 (1 to 12.4 GHz) Coupler Narda 4016-10 (12.4 to 18 GHz) Coupler HP 8472A (.01 to 18 GHz) Detector
VLF Comparator	Receives WWVB or WWVL. Accepts 1 MHz input signal.	HP 117A with optional input divider.

SECTION VIII

REPLACEABLE PARTS

8-1. GENERAL

8-2. This section contains information for ordering replacement parts. Table 8-1 lists parts in alpha-numerical order by reference designator and provides the following information on each part.

a. Description of the part (refer to list of abbreviations and reference designators).

b. Typical manufacturer of the part in a five-digit code (see list of manufacturers).

c. Manufacturer's part number.

d. Quantity used in each assembly (AQ column).

e. Miscellaneous parts are listed at the end of Table 8-1.

8-3. ORDERING INFORMATION

8-4. To obtain replacement parts, address order or inquiry to EIP, Inc., 380 Martin Avenue, Santa Clara, California, 95052, Attention: Customer Service.

8-5. To obtain a part that is not listed, include:

a. Instrument model number.

b. Instrument serial number.

c. Description of the part.

d. Function and location of the part.

8-6. MANUFACTURERS CODES

8-7. The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks HR-1 (Name to Code) and HR-2 (Code to Name) and their latest supplements. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the HR Handbooks.

CODE LIST OF MANUFACTURERS

Code No.	Name and Address
01295	Texas Instruments, Inc. Transistor Products Division Dallas, Texas
02114	Ferroxcube Corp. of America Saugerties, New York
02660	Amphenol-Borg Electronics Corp. Chicago, Illinois
02735	RCA Semiconductor & Materials Division Somerville, New Jersey
04713	Motorola, Inc. Semiconductor Products Division Phoenix, Arizona
05591	General Resistance, Inc./Chronetics Mt. Vernon, New York
07263	Fairchild Camera & Instruments Corp. Semiconductor Division Mountain View, California
08277	Rotron Manufacturing Company, Inc. Woodstock, New York
08730	Vemaline Products Company Wyckoff, New Jersey
09353	C & K Components, Inc. Newton, Massachusetts
12463	Om-tronics Omaha, Nebraska
14099	Sem-Tech Newbury Park, California
15636	Electrol Company, Inc. York, Pennsylvania
21604	Buckeye Stamping Company Columbia, Ohio
23880	Stanford Applied Engineering Santa Clara, California
27014	National Semiconductor Santa Clara, California
28480	Hewlett-Packard Company Palo Alto, California
30983	Electra Division Midland Corporation Mineral Wells, Texas
56289	Sprague Electric Company North Adams, Massachusetts
70903	Belden Manufacturing Company Chicago, Illinois
71400	Bussmann Manufacturing Division McGraw-Edison Company St. Louis, Missouri
71785	Cinch Manufacturing Company Howard B. Jones Division Chicago, Illinois

Code No.	Name and Address
72136	Electro Motive Manufacturing Co., Inc. Willimantic, Connecticut
72259	Nytronics, Inc. Berkeley Heights, New Jersey
72982	Erie Technological Products, Inc. Erie, Pennsylvania
73138	Helipot Division Beckman Instruments, Inc. Fullerton, California
73445	Amperex Electric Company Hicksville, New York
73899	JFD Electric Corporation Brooklyn, New York
75042	International Resistance Company Philadelphia, Pennsylvania
75915	Littelfuse, Inc. Des Plaines, Illinois
79727	Continental-Wirt Electronics Corp. Philadelphia, Pennsylvania
80294	Bourns, Inc. Riverside, California
81349	Military Specification
82142	Jeffers Electronics Division Speer Carbon Company DuBois, Pennsylvania
82389	Switchcraft, Inc. Chicago, Illinois
91506	Augat, Inc. Attleboro, Massachusetts
91637	Dale Electronics, Inc. Columbus, Nebraska
93459	Weinschel Gaithersburg, Maryland
95077	General RF Fittings Solitron Devices Pt. Salerno, Florida
98291	Sealectro Corporation Mamaroneck, New York
99392	STM Corporation Oakland, California

The following vendors have no number assigned in the Federal Supply Code for Manufacturers Handbook:

000A	Schadow International Electro Exchange Minneapolis, Minnesota
0000B	Stettner-Trush, Inc. Cazenovia, New York
0000C	Richco Plastic Company Chicago, Illinois

REFERENCE DESIGNATORS

A	=	assembly
AT	=	termination
B	=	fan
C	=	capacitor
DR	=	diode
DS	=	device signal (lamp)
E	=	misc. electrical part
F	=	fuse
IC	=	integrated circuit
J	=	jack
K	=	relay
L	=	inductor
MP	=	mechanical part
Q	=	transistor
R	=	resistor
RFC	=	RF choke
S	=	switch
T	=	transformer
TP	=	test point
V	=	vacuum tube, neon bulb, photocell, etc.
VR	=	varactor diode
W	=	cable
X	=	socket
Y	=	crystal

ABBREVIATIONS

A	=	amperes
AMPL	=	amplifier
BCD	=	Binary-coded decimal
BP	=	bandpass
CCW	=	counterclockwise
CER	=	ceramic
CKT	=	circuit
COM	=	common
COMP	=	composition
COMPL	=	complete
CONN	=	connector
CRT	=	cathode-ray tube
CW	=	clockwise/continuous wave
D/A	=	digital-to-analog
DEPC	=	deposited carbon
DR	=	drive
ELECT	=	electrolytic
ENCAP	=	encapsulated
EXT	=	external
F	=	farads
FH	=	flat head
FSP	=	factory selected part
FXD	=	fixed
G	=	giga (10^9)
GL	=	glass
GRD	=	ground(ed)
H	=	henry(s)
HDW	=	hardware
HR	=	hour(s)
Hz	=	hertz
IF		intermediate freq
INCD	=	incandescent
INCL	=	include(s)
INS	=	insulation(ed)
INT	=	internal
INTEG	=	integrated
K	=	kilo = 1000
LH	=	left hand
LIN	=	linear taper
LOG	=	logarithmic taper
LPF	=	low pass filter
M	=	mili = 10^{-3}
MEG	=	meg = 10^6
MET FLM	=	metal film
MET OX	=	metallic oxide
MFR	=	manufacturer
MHz	=	mega hertz
MINAT	=	minature
MOM	=	momentary
MTG	=	mounting
N	=	nano (10^{-9})
N/C	=	normally closed
NE	=	neon
N/O	=	normally open
NPN	=	negative-positive-negative
NRFR	=	not recommended for field replacement
NSR	=	not separately replaceable
OBD	=	order by description
OP	=	operational
OSC	=	oscillator
PC	=	printed circuit
PF	=	picofarads = 10^{-12}
PIV	=	peak inverse voltage
PNP	=	positive-negative-positive
P/O	=	part of
POS	=	position(s)
POT	=	potentiometer
PP	=	peak-to-peak
PT	=	point
PWV	=	peak working voltage
RECT	=	rectifier
RF	=	radio frequency
RH	=	round head or right hand
RMO	=	rack mount only
RMS	=	root-mean square
RWV	=	reverse working voltage
S-B	=	slow-blow
SECT	=	section(s)
SEMICON	=	semiconductor
SI	=	silicon
SPL	=	special
SST	=	stainless steel
TD	=	time delay
TGL	=	toggle
TOL	=	tolerance
TRIM	=	trimmer
TWT	=	traveling-wave tube
U	=	micro = 10^{-6}
VAR	=	variable
VDCW	=	dc working volts
W/	=	with
W	=	watts
WIV	=	working inverse voltage
WW	=	wirewound
W/O	=	without
YIG	=	Yitrium-iron-garnet

TABLE 8-1

REFERENCE DESIGNATION	DESCRIPTION/ /NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A001	PC ASSY:HIGH FREQUENCY BOARD	04-100731-01	EIP	1
A001C1	C:FXD MET FLM .1 UF 20% 250VDCW	C280AE/P100K	73445	5
A001C2	C:FXD MET FLM .1 UF 20% 250VDCW	C280AE/P100K	73445	5
A001C3	C:FXD MICA 5 PF 500VDCW	DM-15-050D	72136	3
A001C4	C:FXD ELECT TA 4.7 UF 10% 10VDCW	CS13BC475K	81349	6
A001C5	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C6	C:FXD CER .001 UF 20% 1K VDCW	5GA-D10	56289	7
A001C7	C:FXD CER .001 UF 20% 1K VDCW	5GA-D10	56289	7
A001C8	C:FXD ELECT TA 4.7 UF 10% 10VDCW	CS13BC475K	81349	6
A001C9	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C10	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C11	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C12	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	15
A001C13	C:FXD ELECT TA 4.7 UF 10% 10VDCW	CS13BC475K	81349	6
A001C14	C:FXD ELECT TA 4.7 UF 10% 10VDCW	CS13BC475K	81349	6
A001C15	C:FXD CER .001 UF 20% 1K VDCW	5GA-D10	56289	7
A001C16	C:FXD ELECT TA 4.7 UF 10% 10VDCW	CS13BC475K	81349	6
A001C17	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	15
A001C18	C:FXD CER .001 UF 20% 1K VDCW	5GA-D10	56289	7
A001C19	C:FXD MET FLM .1 UF 20% 250VDCW	C280AE/P100K	73445	5
A001C20	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	15
A001C21	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	15
A001C22	C:FXD CER .001 UF 20% 1K VDCW	5GA-D10	56289	7
A001C23	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C24	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C25	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C26	C:FXD MICA 220 PF 5% 500VDCW	DM-15-221J	72136	1
A001C27	C:FXD CER .001 UF 20% 1K VDCW	5GA-D10	56289	7
A001C28	C:FXD ELECT TA 4.7 UF 10% 10VDCW	CS13BC475K	81349	6
A001C29	C:FXD MET FLM .1 UF 20% 250VDCW	C280AE/P100K	73445	5
A001C30	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	15
A001C31	C:FXD CER .001 UF 20% 1K VDCW	5GA-D10	56289	7
A001C32	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C33	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C34	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C35	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C36	C:FXD MET FLM .1 UF 20% 250VDCW	C280AE/P100K	73445	5
A001C37	C:FXD MICA S.A.T. PF 5% 500VDCW	DM-15-XXXJ	72136	1
A001C38	C:FXD MICA 5 PF 500VDCW	DM-15-050D	72982	3
A001C39	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	15
A001C40	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	15
A001C41	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	15
A001C42	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	15
A001C43	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	15
A001C44	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	15
A001C45	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	15
A001C46	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	15
A001C47	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C48	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	15
A001C49	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C50	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	15
A001C51	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C52	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C53	C:FXD MICA 5 PF 500VDCW	DM-15-050D	72136	3
A001C54	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	16
A001C55	CAP:FXD CER .05 UF 20% 20VDCW	UK20-503	73899	1
A001C56	C:FXD MICA 820PF 5% 200VDCW	DM15-821J	73899	1
A001CR1	DIODE:SI RECT	FD600	07263	4
A001CR2	DIODE:SI RECT	FD600	07263	4
A001CR3	DIODE:SI SIGNAL	1N3064	04713	3
A001CR4	DIODE:SI SIGNAL	1N3064	04713	3
A001CR5	DIODE:SI ZENER	1N5221	04713	2
A001CR6	DIODE:SI TUNNEL	1N3719	04713	2
A001CR7	DIODE:SI SIGNAL	1N3064	04713	3
A001CR8	DIODE:SI TUNNEL	1N3719	04713	2
A001CR9	DIODE:SI ZENER	1N5221	04713	2
A001CR10	DIODE:SI RECT	FD600	07263	4
A001CR11	DIODE:SI RECT	FD600	07263	4
A001CR12	DIODE:SI ZENER	1N5341A	04713	1
A001CR13	DIODE:SI ZENER	1N5231A	04713	1
A001IC1	INTEG CKT:DUAL TRIGGER/TRIPLE AMPL	MC1035P	04713	1
A001IC2	INTEG CKT:HEX INVERTER	DM7405N	27014	1
A001IC3	INTEG CKT:DUAL 4-INPUT OR/NOR GATE	MC1660L	04713	2
A001IC4	INTEG CKT:J-K FLIP FLOP	MC1013P	04713	4
A001IC5	INTEG CKT:M-S TYPE D SLIP-FLOP	MC1670L	04713	1
A001IC6	INTEG CKT:DUAL 4-INPUT OR/NOR GATE	MC1660L	04713	2
A001IC7	INTEG CKT:TYPE D FLIP-FLOP	MC1034P	04713	1
A001IC8	INTEG CKT:J-K FLIP FLOP	MC1013P	04713	4
A001IC9	INTEG CKT:COMPARATOR	LM710CN	27014	4
A001IC10	INTEG CKT:J-K FLIP FLOP	MC1013P	04713	4
A001IC11	INTEG CKT:COMPARATOR	LM710CN	27014	4
A001IC12	INTEG CKT:J-K FLIP FLOP	MC1013P	04713	4
A001IC13	INTEG CKT:COMPARATOR	LM710CN	27014	4
A001IC14	INTEG CKT:COMPARATOR	LM710CN	27014	4
A001J1	CONN:COAX:RT ANGLE	51-053-0000	98291	2
A001J2	CONN:COAX:RT ANGLE	51-053-0000	98291	2
A001K1	RELAY	RA30201121	15636	2

REFERENCE DESIGNATION	DESCRIPTION/NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A001K2	RELAY	RA30201121	15636	2
A001L1	INDUCTOR:FXD .15 UH 20%	4415-1M	82142	5
A001L2	INDUCTOR:FXD .15 UH 20%	4415-1M	82142	5
A001L4	INDUCTOR:FXD .15 UH 20%	4415-1M	82142	5
A001L5	INDUCTOR:FXD	33-100796-01	EIP	1
A001L6	INDUCTOR:FXD .15 UH 20%	4415-1M	82142	5
A001L7	INDUCTOR:FXD:FERRITE BEAD	56-590-65/3B	02114	3
A001L8	INDUCTOR:FXD .15 UH 20%	4415-1M	82142	5
A001L9	INDUCTOR:FXD:FERRITE BEAD	56-590-65/3B	02114	3
A001L10	INDUCTOR:FXD:FERRITE BEAD	56-590-65/3B	02114	3
A001Q1	TRANSISTOR:NPN	2N5179	04713	16
A001Q2	TRANSISTOR:NPN	2N5179	04713	16
A001Q3	TRANSISTOR:NPN	2N4401	04713	7
A001Q4	TRANSISTOR:NPN	2N5179	04713	16
A001Q5	TRANSISTOR:NPN	2N5179	04713	16
A001Q6	TRANSISTOR:NPN	2N5179	04713	16
A001Q7	TRANSISTOR:NPN	2N4401	04713	7
A001Q8	TRANSISTOR:NPN	2N5179	04713	16
A001Q9	TRANSISTOR:NPN	2N5179	04713	16
A001Q10	TRANSISTOR:NPN	2N4401	04713	7
A001Q11	TRANSISTOR:NPN	2N5179	04713	16
A001Q12	TRANSISTOR:NPN	2N5179	04713	16
A001Q13	TRANSISTOR:NPN	2N5179	04713	16
A001Q14	TRANSISTOR:NPN	2N5179	04713	16
A001Q15	TRANSISTOR:NPN	2N5179	04713	16
A001Q16	TRANSISTOR:NPN	2N5179	04713	16
A001Q17	TRANSISTOR:NPN	2N5179	04713	16
A001Q18	TRANSISTOR:NPN	2N5179	04713	16
A001Q19	TRANSISTOR:JFET	2N4416	04713	1
A001Q20	TRANSISTOR:NPN	2N4401	04713	7
A001Q21	TRANSISTOR:NPN	2N4401	04713	7
A001Q22	TRANSISTOR:NPN	2N4401	04713	7
A001Q23	TRANSISTOR:NPN	2N5179	04713	16
A001Q24	TRANSISTOR:NPN	2N4401	04713	7
A001R1	R:FXD COMP 43 OHM 5% 1/4W	RC07GF430J	81349	2
A001R2	R:FXD COMP 43 OHM 5% 1/4W	RC07GF430J	81349	2
A001R3	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	13
A001R4	R:FXD COMP 15K OHM 5% 1/4W	RC07GF153J	81349	1
A001R5	R:FXD COMP 5.6 OHM 5% 1/4W	RC07GF5R6J	81349	8
A001R6	R:FXD COMP 390 OHM 5% 1/4W	RC07GF391J	81349	1
A001R7	R:FXD COMP 150 OHM 5% 1/4W	RC07GF151J	81349	4
A001R8	R:FXD COMP 150 OHM 5% 1/4W	RC07GF151J	81349	4

REFERENCE DESIGNATION	DESCRIPTION/NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A001R9	R:FXD COMP 8.2K OHM 5% 1/4W	RC07GF822J	81349	1
A001R10	R:FXD COMP 12 OHM 5% 1/4W	RC07GF120J	81349	4
A001R11	R:FXD COMP 6.2K OHM 5% 1/4W	RC07GF622J	81349	1
A001R12	R:FXD COMP 470 OHM 5% 1/4W	RC07GF471J	81349	5
A001R13	R:FXD COMP 240 OHM 5% 1/4W	RC07GF241J	81349	4
A001R14	R:FXD COMP 6.8 OHM 5% 1/4W	RC07GF6R8J	81349	3
A001R15	R:FXD COMP 5.6 OHM 5% 1/4W	RC07GF5R6J	81349	8
A001R16	R:FXD COMP 240 OHM 5% 1/4W	RC07GF241J	81349	4
A001R17	R:FXD COMP 75 OHM 5% 1/4W	RC07GF750J	81349	1
A001R18	R:FXD COMP 360 OHM 5% 1/4W	RC07GF361J	81349	1
A001R19	R:FXD COMP 240 OHM 5% 1/4W	RC07GF241J	81349	4
A001R20	R:FXD COMP 240 OHM 5% 1/4W	RC07GF241J	81349	4
A001R21	R:FXD COMP 6.8 OHM 5% 1/4W	RC07GF6R8J	81349	3
A001R22	R:FXD COMP 150 OHM 5% 1/4W	RC07GF151J	81349	4
A001R23	R:FXD COMP 910 OHM 5% 1/4W	RC07GF911J	81349	3
A001R24	R:FXD COMP 270 OHM 5% 1/4W	RC07GF271J	81349	3
A001R25	R:FXD COMP 910 OHM 5% 1/4W	RC07GF911J	81349	3
A001R26	R:FXD COMP 270 OHM 5% 1/4W	RC07GF271J	81349	3
A001R27	R:FXD COMP 2K OHM 5% 1/4W	RC07GF202J	81349	1
A001R28	R:FXD COMP 910 OHM 5% 1/4W	RC07GF911J	81349	3
A001R29	R:FXD COMP 5.6K OHM 5% 1/4W	RC07GF562J	81349	7
A001R30	R:FXD COMP 12 OHM 5% 1/4W	RC07GF120J	81349	4
A001R31	R:FXD COMP 5.6 OHM 5% 1/4W	RC07GF5R6J	81349	8
A001R32	R:FXD MET FLM 2.1K OHM 1% 1/8W	RN55D2101F	81349	1
A001R33	R:FXD COMP 5.6 OHM 5% 1/4W	RC07GF5R6J	81349	8
AC01R34	R:FXD MET FLM 374 OHM 1% 1/8W	RN55D3740F	81349	1
A001R35	R:FXD COMP 18 OHM 5% 1/4W	RC07GF180J	81349	1
A001R36	R:FXD MET FLM 100 OHM 1% 1/8W	RN55D1000F	81349	1
A001R37	R:FXD COMP 5.6 OHM 5% 1/4W	RC07GF5R6J	81349	8
A001R38	R:VAR CERMET 5K OHM 3/4W	89-PR5K	73138	2
A001R39	R:FXD COMP 12 OHM 5% 1/4W	RC07GF120J	81349	4
AC01R40	R:FXD COMP 5.6K OHM 5% 1/4W	RC07GF562J	81349	7
A001R41	R:FXD COMP 470 OHM 5% 1/4W	RC07GF471J	81349	5
A001R42	R:FXD COMP 68 OHM 5% 1/4W	RC07GF680J	81349	1
A001R43	R:FXD COMP 5.6K OHM 5% 1/4W	RC07GF562J	81349	7
A001R44	R:VAR CERMET 1K OHM 3/4W	89-PR1K	73138	1
A001R45	R:FXD COMP 5.6 OHM 5% 1/4W	RC07GF5R6J	81349	8
A001R46	R:FXD COMP 5.6 OHM 5% 1/4W	RC07GF5R6J	81349	8
A001R47	R:VAR CERMET 5K OHM 3/4W	89-PR5K	73138	2
A001R48	R:FXD COMP 820 OHM 5% 1/4W	RC07GF821J	81349	2
A001R49	R:FXD COMP 33 OHM 5% 1/4W	RC07GF330J	81349	2
A001R50	R:FXD COMP 51 OHM 5% 1/4W	RC07GF510J	81349	2
A001R51	R:FXD COMP 33 OHM 5% 1/4W	RC07GF330J	81349	2
A001R52	R:FXD COMP 750 OHM 5% 1/4W	RC07GF751J	81349	1
A001R53	R:FXD COMP 150 OHM 5% 1/4W	RC07GF151J	81349	4
A001R54	R:FXD COMP 5.6 OHM 5% 1/4W	RC07GF5R6J	81349	8
A001R55	R:FXD COMP 100 OHM 5% 1/4W	RC07GF101J	81349	2
A001R56	R:FXD COMP 12 OHM 5% 1/4W	RC07GF120J	81349	4

REFERENCE DESIGNATION	DESCRIPTION/NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A001R57	R:FXD COMP 270 OHM 5% 1/4W	RC07GF271J	81349	3
A001R58	R:FXD COMP 470 OHM 5% 1/4W	RC07GF471J	81349	5
A001R59	R:VAR CERMET 100 OHM 3/4W	89-PR100	73138	1
A001R60	R:FXD COMP 220 OHM 5% 1/4W	RC07GF221J	81349	4
A001R61	R:FXD COMP 6.8 OHM 5% 1/4W	RC07GF6R8J	81349	3
A001R62	R:FXD COMP 820 OHM 5% 1/4W	RC07GF821J	81349	2
A001R63	R:FXD COMP 220 OHM 5% 1/4W	RC07GF221J	81349	4
A001R64	R:FXD COMP 100 OHM 5% 1/4W	RC07GF101J	81349	2
A001R65	R:FXD COMP 620 OHM 5% 1/4W	RC07GF621J	81349	1
A001R66	R:FXD COMP 36 OHM 5% 1/4W	RC07GF360J	81349	1
A001R67	R:FXD COMP 470 OHM 5% 1/4W	RC07GF471J	81349	5
A001R68	R:FXD COMP 820K OHM 5% 1/4W	RC07GF824J	81349	1
A001R69	R:FXD COMP 200K OHM 5% 1/4W	RC07GF204J	81349	1
A001R70	R:FXD COMP 3.9K OHM 5% 1/4W	RC07GF392J	81349	1
A001R71	R:FXD COMP 3K OHM 5% 1/4W	RC07GF302J	81349	2
A001R72	R:FXD COMP 3K OHM 5% 1/4W	RC07GF302J	81349	2
A001R73	R:VAR CERMET 10K OHM 3/4W	89-PR10K	73138	1
A001R74	R:FXD COMP 470 OHM 5% 1/4W	RC07GF471J	81349	5
A001R75	R:FXD COMP 220 OHM 5% 1/4W	RC07GF221J	81349	4
A001R76	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	13
A001R77	R:FXD COMP 510 OHM 5% 1/4W	RC07GF511J	81349	7
A001R78	R:FXD COMP 180 OHM 5% 1/2W	RC20GF181J	81349	1
A001R79	R:FXD COMP 2.2K OHM 5% 1/4W	RC07GF222J	81349	4
A001R80	R:FXD COMP 560 OHM 5% 1/4W	RC07GF561J	81349	4
A001R81	R:FXD COMP 5.6K OHM 5% 1/4W	RC07GF562J	81349	7
A001R82	R:FXD COMP 2.2K OHM 5% 1/4W	RC07GF222J	81349	4
A001R83	R:FXD COMP 560 OHM 5% 1/4W	RC07GF561J	81349	4
A001R84	R:FXD COMP 5.6K OHM 5% 1/4W	RC07GF562J	81349	7
A001R85	R:FXD COMP 2.2K OHM 5% 1/4W	RC07GF222J	81349	4
A001R86	R:FXD COMP 560 OHM 5% 1/4W	RC07GF561J	81349	4
A001R87	R:FXD COMP 5.6K OHM 5% 1/4W	RC07GF562J	81349	7
A001R88	R:FXD COMP 220 OHM 5% 1/4W	RC07GF221J	81349	4
A001R89	R:FXD COMP 56 OHM 5% 1/4W	RC07GF560J	81349	1
A001R90	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	13
A001R91	R:FXD COMP 2.2K OHM 5% 1/4W	RC07GF222J	81349	4
A001R92	R:FXD COMP 560 OHM 5% 1/4W	RC07GF561J	81349	4
A001R93	R:FXD COMP 5.6K OHM 5% 1/4W	RC07GF562J	81349	7
A001R94	R:FXD COMP 510 OHM 5% 1/4W	RC07GF511J	81349	7
A001R95	R:FXD COMP 510 OHM 5% 1/4W	RC07GF511J	81349	7
A001R96	R:FXD COMP 430 OHM 5% 1/4W	RC07GF431J	81349	1
A001R97	R:FXD COMP 51 OHM 5% 1/4W	RC07GF510J	81349	2
A001R98	R:FXD COMP 510 OHM 5% 1/4W	RC07GF511J	81349	7
A001R99	R:FXD COMP 510 OHM 5% 1/4W	RC07GF511J	81349	7
A001R100	R:FXD COMP 510 OHM 5% 1/4W	RC07GF511J	81349	7
A001R101	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	13
A001R102	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	13
A001R103	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	13
A001R104	R:FXD COMP 510 OHM 5% 1/4W	RC07GF511J	81349	7

REFERENCE DESIGNATION	DESCRIPTION/NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A001R105	R:FXD COMP 3.6K OHM 5% 1/4W	RC07GF362J	81349	3
A001R106	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	13
A001R107	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	13
A001R108	R:FXD COMP 3.6K OHM 5% 1/4W	RC07GF362J	81349	3
A001R109	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	13
A001R110	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	13
A001R111	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	13
A001R112	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	13
A001R113	R:FXD COMP 3.6K OHM 5% 1/4W	RC07GF362J	81349	3
A001R114	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	13
A002	PC ASSY:CONTROL LOGIC BOARD	04-100728-01	EIP	1
A002C1	C:FXD MET FLM .1 UF 20% 250VDCW	C280AE/P100K	73445	2
A002C2	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	5
A002C3	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C4	C:FXD ELECT TA 6.8 UF 10% 35VDCWU	CS13BF685K	81349	5
A002C5	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C6	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C7	C:FXD MICA 220 PF 5% 500VDCW	DM-15-221J	72136	1
A002C8	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C9	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C10	C:FXD MICA 47 PF 5% 500VDCW	DM-15-470J	72136	1
A002C11	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C12	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C13	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C17	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C18	C:FXD ELECT TA 6.8 UF 10% 35VDCWU	CS13BF685K	81349	5
A002C19	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C20	C:FXD CER .05 UF 10% 200V	UK20-503	56289	2
A002C21	C:FXD CER .05 UF 10% 200V	UK20-503	56289	2
A002C22	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C23	C:FXD ELECT TA 6.8 UF 10% 35VDCWU	CS13BF685K	81349	5
A002C24	C:FXD ELECT TA 6.8 UF 10% 35VDCWU	CS13BF685K	81349	5
A002C25	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C26	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C27	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C28	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C29	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C30	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C31	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C32	C:FXD CER 27 UF 10% 35V	CS13BC276K	56289	1
A002C33	C:FXD MICA 470 PF 5% 500VDCW	DM-15-471J	72136	6
A002C34	C:FXD MICA 470 PF 5% 500VDCW	DM-15-471J	72136	6
A002C35	C:FXD MICA 470 PF 5% 500VDCW	DM-15-471J	72136	6
A002C36	C:FXD MICA 470 PF 5% 500VDCW	DM-15-471J	72136	6
A002C37	C:FXD MICA 470 PF 5% 500VDCW	DM-15-471J	72136	6

REFERENCE DESIGNATION	DESCRIPTION/ /NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A002C38	C:FXD MICA 470 PF 5% 500VDCW	DM-15-471J	72136	6
A002C39	C:FXD MET FLM .1 UF 20% 250VDCW	C280AE/P100K	73445	2
A002C40	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C41	C:FXD CER .005 UF 20% 100VDCW	TG-S10	56289	20
A002C42	C:FXD ELECT TA 56 UF 10% 15VDCW	CS13BD566K	81349	1
A002CR1	DIODE:SI SIGNAL	1N3064	04713	4
A002CR2	DIODE:SI SIGNAL	1N3064	04713	4
A002CR3	DIODE:SI ZENER	1N751A	04713	1
A002CR4	DIODE:SI SIGNAL	1N3064	04713	4
A002CR5	DIODE:SI SIGNAL	1N3064	04713	4
A002CR8	DIODE:SI RECTIFIER	1N4001	04713	2
A002CR9	DIODE:SI RECTIFIER	1N4001	04713	2
A002CR10	DIODE:SI ZENER	1N5341A	04713	1
A002IC1	INTEG CKT:HEX INVERTER	DM7404N	27014	6
A002IC2	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	9
A002IC3	INTEG CKT:TRIPLE 3-INPUT NAND GATE	DM7410N	27014	4
A002IC4	INTEG CKT:ONE-SHOT	DM8601N	27014	1
A002IC5	INTEG CKT:HEX INVERTER	DM7404N	27014	6
A002IC6	INTEG CKT:QUAD 2-INPUT NAND GATE	DM7400N	27014	6
A002IC7	INTEG CKT:VOLTAGE COMPARATOR	LM710CN	27014	1
A002IC8	INTEG CKT:QUAD 2-INPUT NAND GATE	DM7400N	27014	6
A002IC9	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	9
A002IC10	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	9
A002IC11	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	9
A002IC12	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	9
A002IC13	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	9
A002IC14	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	9
A002IC15	INTEG CKT:DUAL D FLIP-FLOP	DM7474N	27014	1
A002IC16	INTEG CKT:TRIPLE 3-INPUT NAND GATE	DM7410N	27014	4
A002IC17	INTEG CKT:QUAD 2-INPUT NAND GATE	DM7400N	27014	6
A002IC18	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	9
A002IC19	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	9
A002IC20	INTEG CKT:TRIPLE 3-INPUT NAND GATE	DM7410N	27014	4
A002IC21	INTEG CKT:TRIPLE 3-INPUT NAND GATE	DM7410N	27014	4
A002IC23	INTEG CKT:HEX INVERTER	DM7404N	27014	6
A002IC24	INTEG CKT:HEX INVERTER	DM7404N	27014	6
A002IC25	INTEG CKT:QUAD 2-INPUT NAND GATE	DM7400N	27014	6
A002IC26	INTEG CKT:QUAD 2-INPUT NAND GATE	DM7400N	27014	6
A002IC27	INTEG CKT:HEX INVERTER	DM7404N	27014	6
A002IC28	INTEG CKT:HEX INVERTER	DM7404N	27014	6
A002IC29	INTEG CKT:8-INPUT NAND GATE	DM7430N	27014	2
A002IC30	INTEG CKT:DUAL 4-INPUT NAND GATE	DM7420N	27014	1
A002IC31	INTEG CKT:QUAD 2-INPUT NOR GATE	DM7402N	27014	1
A002IC32	INTEG CKT:BCD/DEC DECODER/DRIVER	DM7442N	27014	1
A002IC33	INTEG CKT:QUAD 2-INPUT NAND GATE	DM7400N	27014	6
A002IC34	INTEG CKT:8-INPUT NAND GATE	DM7430N	27014	2
A002Q1	TRANSISTOR:NPN	2N4401	04713	14
A002Q2	TRANSISTOR:NPN	2N4401	04713	14
A002Q3	TRANSISTOR:NPN	2N4401	04713	14
A002Q4	TRANSISTOR:NPN	2N4401	04713	14
A002Q5	TRANSISTOR:NPN	2N4401	04713	14
A002Q6	TRANSISTOR:NPN	2N4401	04713	14
A002Q7	TRANSISTOR:NPN	2N4401	04713	14
A002Q8	TRANSISTOR:NPN	2N4401	04713	14
A002Q9	TRANSISTOR:NPN	2N4401	04713	14
A002Q10	TRANSISTOR:NPN	2N4401	04713	14
A002Q11	TRANSISTOR:NPN	2N4401	04713	14
A002Q12	TRANSISTOR:NPN	2N4401	04713	14
A002Q13	TRANSISTOR:NPN	2N4401	04713	14
A002Q14	TRANSISTOR:NPN	2N4401	04713	14
A002R1	R:FXD COMP 100 OHM 5% 1/4W	RC07GF101J	81349	3
A002R2	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R3	R:FXD COMP 7.5K OHM 5% 1/2W	RC07GF752J	81349	1
A002R4	R:FXD COMP 100 OHM 5% 1/4W	RC07GF101J	81349	3
A002R5	R:FXD COMP 270 OHM 5% 1/2W	RC20GF271J	81349	1
A002R6	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	7
A002R7	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	7
A002R8	R:FXD COMP 220 OHM 5% 1/4W	RC07GF221J	81349	1
A002R9	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R10	R:FXD COMP 2.2K OHM 5% 1/4W	RC07GF222J	81349	4
A002R11	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R12	R:FXD COMP 560 OHM 5% 1/4W	RC07GF561J	81349	3
A002R13	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R14	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R15	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R23	R:FXD COMP 100 OHM 5% 1/4W	RC07GF101J	81349	3
A002R24	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	7
A002R25	R:FXD COMP 1.5K OHM 5% 1/4W	RC07GF152J	81349	1
A002R26	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R27	R:FXD COMP 5.6 OHM 5% 1/4W	RC07GF5R6J	81349	2
A002R28	R:FXD COMP 33K OHM 5% 1/4W	RC07GF333J	81349	3
A002R29	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R30	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R31	R:FXD COMP 560 OHM 5% 1/4W	RC07GF561J	81349	3
A002R32	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R33	R:FXD COMP 5.6 OHM 5% 1/4W	RC07GF5R6J	81349	2
A002R34	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R35	R:FXD COMP 33K OHM 5% 1/4W	RC07GF333J	81349	3

TABLE 8-1

REFERENCE DESIGNATION	DESCRIPTION/NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A002R36	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R37	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R38	R:FXD COMP 560 OHM 5% 1/4W	RC07GF561J	81349	3
A002R39	R:FXD COMP 33K OHM 5% 1/4W	RC07GF333J	81349	3
A002R40	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R41	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R42	R:FXD COMP 330 OHM 5% 1/4W	RC07GF331J	81349	1
A002R43	R:FXD COMP 680 OHM 5% 1/4W	RC07GF681J	81349	1
A002R44	R:FXD COMP 27K OHM 5% 1/4W	RC07GF273J	81349	4
A002R45	R:FXD COMP 27K OHM 5% 1/4W	RC07GF273J	81349	4
A002R46	R:FXD COMP 2.2K OHM 5% 1/4W	RC07GF222J	81349	4
A002R47	R:FXD COMP 27K OHM 5% 1/4W	RC07GF273J	81349	4
A002R48	R:FXD COMP 27K OHM 5% 1/4W	RC07GF273J	81349	4
A002R49	R:FXD COMP 2.2K OHM 5% 1/4W	RC07GF222J	81349	4
A002R50	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R51	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R52	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R53	R:FXD COMP 130K OHM 5% 1/2W	RC07GF134J	81349	1
A002R54	R:FXD COMP 3.3K OHM 5% 1/4W	RC07GF332J	81349	4
A002R55	R:FXD COMP 3.3K OHM 5% 1/4W	RC07GF332J	81349	4
A002R56	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R57	R:FXD COMP 6.8K OHM 5% 1/4W	RC07GF682J	81349	4
A002R58	R:FXD COMP 6.8K OHM 5% 1/4W	RC07GF682J	81349	4
A002R59	R:FXD COMP 6.8K OHM 5% 1/4W	RC07GF682J	81349	4
A002R60	R:FXD COMP 3.3K OHM 5% 1/4W	RC07GF332J	81349	4
A002R61	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R62	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	7
A002R63	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	7
A002R64	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	7
A002R65	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R66	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	7
A002R67	R:FXD COMP 2.2K OHM 5% 1/4W	RC07GF222J	81349	4
A002R68	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R69	R:FXD COMP 3.3K OHM 5% 1/4W	RC07GF332J	81349	4
A002R70	R:FXD COMP 6.8K OHM 5% 1/4W	RC07GF682J	81349	4
A002R71	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	23
A002R72	R:FXD COMP 150 OHM 5% 1/4W	RC07GF151J	81349	1
A002R73	R:FXD COMP S.A.T. OHM 5% 1/4W	RC07GFXXXJ	81349	1
A002R74	R:FXD COMP 30K OHM 5% 1/4W	RC07GF303J	81349	1
A003	PC ASSY:DISPLAY BOARD	04-100771-01	EIP	1
A003C1	C:FXD CER .001 UF 20% 100VDCW	5GA-D10	56289	7
A003C2	C:FXD CER .001 UF 20% 100VDCW	5GA-D10	56289	7
A003C3	C:FXD CER .001 UF 20% 100VDCW	5GA-D10	56289	7
A003C4	C:FXD CER .001 UF 20% 100VDCW	5GA-D10	56289	7
A003C5	C:FXD CER .001 UF 20% 100VDCW	5GA-D10	56289	7
A003C6	C:FXD CER .001 UF 20% 100VDCW	5GA-D10	56289	7
A003C7	C:FXD CER .001 UF 20% 100VDCW	5GA-D10	56289	7
A003C8	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	9
A003C9	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	9
A003C10	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	9
A003C11	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	9
A003C12	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	9
A003C13	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	9
A003C14	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	9
A003C15	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	9
A003C16	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	1
A003C17	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	9
A003CR1	DIODE:SI 6.2V 5W	1N5341A	04713	1
A003IC1	INTEG CKT:BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A003IC2	INTEG CKT:BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A003IC3	INTEG CKT:BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A003IC4	INTEG CKT:BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A003IC5	INTEG CKT:BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A003IC6	INTEG CKT:BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A003IC7	INTEG CKT:BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A003IC8	INTEG CKT:BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A003IC9	INTEG CKT:BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A003IC10	INTEG CKT:BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A003IC11	INTEG CKT:BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A003IC12	INTEG CKT:QUAD LATCH	DM7475N	27014	11
A003IC13	INTEG CKT:QUAD LATCH	DM7475N	27014	11
A003IC14	INTEG CKT:QUAD LATCH	DM7475N	27014	11
A003IC15	INTEG CKT:QUAD LATCH	DM7475N	27014	11
A003IC16	INTEG CKT:QUAD LATCH	DM7475N	27014	11
A003IC17	INTEG CKT:QUAD LATCH	DM7475N	27014	11
A003IC18	INTEG CKT:QUAD LATCH	DM7475N	27014	11
A003IC19	INTEG CKT:QUAD LATCH	DM7475N	27014	11
A003IC20	INTEG CKT:QUAD LATCH	DM7475N	27014	11
A003IC21	INTEG CKT:QUAD LATCH	DM7475N	27014	11
A003IC22	INTEG CKT:QUAD LATCH	DM7475N	27014	11
A003IC23	INTEG CKT:QUAD 2-INPUT NAND GATE	SN7408N	01295	1
A003IC24	INTEG CKT:QUAD 2-INPUT NAND GATE	DM7400N	27014	4
A003IC25	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	10
A003IC26	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	10
A003IC27	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	10
A003IC28	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	10
A003IC29	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	10
A003IC30	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	10
A003IC31	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	10
A003IC32	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	10

REFERENCE DESIGNATION	DESCRIPTION/NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A003IC33	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	10
A003IC34	INTEG CKT:HEX INVERTER	DM7404N	27014	2
A003IC35	INTEG CKT:QUAD 2-INPUT NAND GATE	DM7400N	27014	4
A003IC36	INTEG CKT:QUAD 2-INPUT NAND GATE	DM7400N	27014	4
A003IC37	INTEG CKT:BCD DECADE COUNTER	DM8280N	27014	10
A003IC38	INTEG CKT:QUAD 2-INPUT NAND GATE	DM7400N	27014	4
A003IC39	INTEG CKT:HEX INVERTER	DM7404N	27014	2
A003J1	CONNECTOR:PC EDGE:25 DUAL CONTACT	50-508-10	71785	1
A003Q1	TRANSISTOR:NPN MODIFIED	20-100894-01	04713	3
A003Q2	TRANSISTOR:NPN MODIFIED	20-100894-01	04713	3
A003Q3	TRANSISTOR:NPN MODIFIED	20-100894-01	04713	3
A003R1	R:FXD COMP 43K OHM 5% 1/2W	RC20GF433J	81349	8
A003R2	R:FXD COMP 43K OHM 5% 1/2W	RC20GF433J	81349	8
A003R3	R:FXD COMP 43K OHM 5% 1/2W	RC20GF433J	81349	8
A003R4	R:FXD COMP 43K OHM 5% 1/2W	RC20GF433J	81349	8
A003R5	R:FXD COMP 43K OHM 5% 1/2W	RC20GF433J	81349	8
A003R6	R:FXD COMP 43K OHM 5% 1/2W	RC20GF433J	81349	8
A003R7	R:FXD COMP 43K OHM 5% 1/2W	RC20GF433J	81349	8
A003R8	R:FXD COMP 43K OHM 5% 1/2W	RC20GF433J	81349	8
A003R9	R:FXD COMP 43K OHM 5% 1W	RC32GF433J	81349	3
A003R10	R:FXD COMP 43K OHM 5% 1W	RC32GF433J	81349	3
A003R11	R:FXD COMP 43K OHM 5% 1W	RC32GF433J	81349	3
A003R12	R:FXD COMP 22K OHM 5% 1W	RC32GF223J	81349	3
A003R13	R:FXD COMP 100K OHM 5% 1/4W	RC07GF104J	81349	3
A003R14	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	1
A003R15	R:FXD COMP 22K OHM 5% 1W	RC32GF223J	81349	3
A003R16	R:FXD COMP 100K OHM 5% 1/4W	RC07GF104J	81349	3
A003R17	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	4
A003R18	R:FXD COMP 22K OHM 5% 1W	RC32GF223J	81349	3
A003R19	R:FXD COMP 100K OHM 5% 1/4W	RC07GF104J	81349	3
A003R20	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	4
A003R21	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	4
A003R22	R:FXD COMP 330 OHM 5% 1/4W	RC07GF331J	81349	3
A003R23	R:FXD COMP 330 OHM 5% 1/4W	RC07GF331J	81349	3
A003R24	R:FXD COMP 330 OHM 5% 1/4W	RC07GF331J	81349	3
A003R25	R:FXD COMP 10K OHM 5% 1/4W	RC07GF103J	81349	4
A003V1	TUBE:NEON GLOW:NUMERIC DISPLAY	NL5750	27014	11
A003V2	TUBE:NEON GLOW:NUMERIC DISPLAY	NL5750	27014	11
A003V3	TUBE:NEON GLOW:NUMERIC DISPLAY	NL5750	27014	11
A003V4	TUBE:NEON GLOW:NUMERIC DISPLAY	NL5750	27014	11
A003V5	TUBE:NEON GLOW:NUMERIC DISPLAY	NL5750	27014	11

REFERENCE DESIGNATION	DESCRIPTION/NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A002V6	TUBE:NEON GLOW:NUMERIC DISPLAY	NL5750	27014	11
A002V7	TUBE:NEON GLOW:NUMERIC DISPLAY	NL5750	27014	11
A003V8	TUBE:NEON GLOW:NUMERIC DISPLAY	NL5750	27014	11
A003V9	TUBE:NEON GLOW:NUMERIC DISPLAY	NL5750	27014	11
A003V10	TUBE:NEON GLOW:NUMERIC DISPLAY	NL5750	27014	11
A003V11	TUBE:NEON GLOW:NUMERIC DISPLAY	NL5750	27014	11
A004	OSCILLATOR,5 MHZ TIME BASE	37-100671-01	EIP	1
A005	PC-ASSY:RECTIFIER POWER SUPPLY	04-100733-01	EIP	1
A005C1	C:FXD CER .01 UF 20% 1K VDCW	5GA-S10	56289	5
A005C2	C:FXD ELECT 40 UF 350VDCW	39D406F350GL4	56289	1
A005C3	C:FXD CER .01 UF 20% 1K VDCW	5GA-S10	56289	5
A005C4	C:FXD ELECT 12500 UF 25VDCW	91C25JA1252	99392	1
A005C5	C:FXD CER .01 UF 20% 1K VDCW	5GA-S10	56289	5
A005C6	C:FXD ELECT 5400 UF 25VDCW	91C25HA542	99392	2
A005C7	C:FXD CER .01 UF 20% 1K VDCW	5GA-S10	56289	5
A005C8	C:FXD ELECT 2700 UF 25VDCW	91C25HA272	99392	1
A005C9	C:FXD CER .01 UF 20% 1K VDCW	5GA-S10	56289	5
A005C10	C:FXD ELECT 5400 UF 25VDCW	91C25HA542	99392	2
A005CR1	DIODE:RECT BRIDGE	SBR4	14099	1
A005CR2	DIODE:RECT BRIDGE	SCBA05	14099	1
A005CR3	DIODE:RECT BRIDGE	SBR05	14099	2
A005CR4	DIODE:RECT BRIDGE	SBR05	14099	2
A005CR5	DIODE:RECT	3SM2	14099	4
A005CR6	DIODE:RECT	3SM2	14099	4
A005CR7	DIODE:RECT	3SM2	14099	4
A005CR8	DIODE:RECT	3SM2	14099	4
A005F1	FUSE:3AG 1/16A 250V	312.062	75915	1
A005F2	FUSE:3AG 1A 250V	312.100	75915	1
A005F3	FUSE:3AB .5A 250V	312.050	75915	1
A005J1	CONNECTOR:PC EDGE,15 PIN	SAE15S1-2	23880	1
A005L1	INDUCTOR:FXD:LAM CORE	34-100764-01	EIP	1
A005R1	R:FXD COMP 470K OHM 5% 1/4W	RC07GF474J	81349	1
A005T1	TRANSFORMER,POWER	34-100760-01	EIP	1
A005T2	TRANSFORMER,POWER	34-100759-01	EIP	1
A005	PC ASSY:REGULATOR:POWER SUPPLY	04-100736-01	EIP	1

TABLE 8-1

REFERENCE DESIGNATION	DESCRIPTION/NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A00[illegible]C1	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	7
A006C2	C:FXD ELECT TA 1.0 UF 10% 50VDCW	CS13BG105K	81349	3
A006C3	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	2
A006C4	C:FXD MICA 1000 PF 5% 500VDCW	DM-15-102J	72136	3
A006C5	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	7
A006C6	C:FXD ELECT TA 47 UF 10% 20VDCW	CS13BE476K	81349	1
A006C10	C:FXD MICA 47 PF 5% 500VDCW	DM-15-470J	72136	1
A006C11	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	7
A006C12	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	7
A006C13	C:FXD ELECT TA 1.0 UF 10% 50VDCW	CS13BG105K	81349	3
A006C14	C:FXD MICA 1000 PF 5% 500VDCW	DM-15-102J	72136	3
A006C15	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	7
A006C16	C:FXD ELECT TA 1.0 UF 10% 50VDCW	CS13BG105K	81349	3
A006C17	C:FXD MICA 1000 PF 5% 500VDCW	DM-15-102J	72136	3
A006C18	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	7
A006C19	C:FXD ELECT TA 6.8 UF 10% 35VDCW	CS13BF685K	81349	7
A006C20	C:FXD CER .01 UF 20% 100VDCW	TG-S10	56289	2
A006CR1	DIODE:SI RECT	1N4001	04713	8
A006CR2	DIODE:SI RECT	1N4001	04713	8
A006CR5	DIODE:SI RECT	1N4001	04713	8
A006CR6	DIODE:SI RECT	1N4001	04713	8
A006CR7	DIODE:SI ZENER	1N963A	04713	1
A006CR8	DIODE:SI RECT	1N4001	04713	8
A006CR9	DIODE:SI RECT	1N4001	04713	8
A006CR10	DIODE:SI RECT	1N4001	04713	8
A006CR11	DIODE:SI RECT	1N4001	04713	8
A006CR12	DIODE:SI ZENER	1N5356B	04713	1
A006IC1	INT CKT:VOLTAGE REGULATOR	LM 305	27014	3
A006IC3	INT CKT:VOLTAGE REGULATOR	LM 305	27014	3
A006IC4	INT CKT:VOLTAGE REGULATOR	LM 304	27014	1
A006IC5	INT CKT:VOLTAGE REGULATOR	LM 305	27014	3
A006L1	INDUCTOR:FXD:FERRITE BEAD	56-590-65/3B	02114	4
A006L3	INDUCTOR:FXD:FERRITE BEAD	56-590-65/3B	02114	4
A006L4	INDUCTOR:FXD:FERRITE BEAD	56-590-65/3B	02114	4
A006L5	INDUCTOR:FXD:FERRITE BEAD	56-590-65/3B	02114	4
A006Q1	TRANSISTOR:NPN	MJE 3055	04713	4
A006Q2	TRANSISTOR:NPN	MJE 520	04713	3
A006Q3	TRANSISTOR:PNP	MJE 370	04713	4
A006Q6	TRANSISTOR:NPN	MJE 3055	04713	4
A006Q7	TRANSISTOR:PNP	MJE 370	04713	4
A006Q8	TRANSISTOR:PNP	2N4402	04713	1
A006Q9	TRANSISTOR:PNP	MJE 370	04713	4
A006Q10	TRANSISTOR:NPN	MJE 3055	04713	4
A006Q11	TRANSISTOR:NPN	MJE 3055	04713	4
A006Q12	TRANSISTOR:NPN	MJE 520	04713	3
A006Q13	TRANSISTOR:PNP	MJE 370	04713	4
A006Q14	TRANSISTOR: NPN	MJE 520	04713	3
A006R1	R:FXD COMP 6.8 OHM 5% 1/4W	RC07GF6R8J	81349	2
A006R2	R:FXD COMP 68 OHM 5% 1/4W	RC07GF680J	81349	4
A006R3	R:FXD COMP 18 OHM 5% 1/4W	RC07GF180J	81349	1
A006R4	R:FXD WW .20 OHM 5% 5W	RS-5	91637	1
A006R5	R:FXD COMP 150 OHM 5% 1/4W	RC07GF151J	81349	1
A006R6	R:FXD COMP 4.7K OHM 5% 1/4W	RC07GF472J	81349	1
A006R7	R:VAR CERMET 2K OHM 3/4W	89-PR2K	73138	2
A006R8	R:FXD COMP 3.3K OHM 5% 1/4W	RC07GF332J	81349	1
A006R9	R:FXD COMP 40 OHM 5W	RS5-40	81349	1
A006R10	R:FXD COMP 10 OHM 3W	242E1005	81349	1
A006R11	R:FXD COMP 1.8K 1/4W	RC07GF182J	81349	1
A006R15	R:FXD COMP 18 OHM 5% 2W	RC42GF180J	81349	1
A006R16	R:FXD COMP 68 OHM 5% 1/4W	RC07GF680J	81349	4
A006R17	R:FXD WW 1.5 OHM 5% 1W	TYPE BWH	75042	1
A006R18	R:FXD COMP 22 OHM 5% 1/4W	RC07GF220J	81349	1
A006R19	R:FXD COMP 360 OHM 5% 1/2W	RC20GF361J	81349	1
A006R20	R:FXD MET FLM 11K OHM 1% 1/8W	RN55C1102F	81349	1
A006R21	R:VAR CERMET 5K OHM 3/4W	89-PR5K	73138	2
A006R22	R:FXD MET FLM 2.43K OHM 1% 1/8W	RN55C2431F	81349	3
A006R23	R:VAR CERMET 2K OHM 3/4W	89-PR2K	73138	2
A006R24	R:FXD MET FLM 2.43K OHM 1% 1/8W	RN55C2431F	81349	3
A006R2[illegible]	R:FXD COMP 68 OHM 5% 1/4W	RC07GF680J	81349	4
A006R25	R:FXD COMP 1K OHM 5% 1/4W	RC07GF102J	81349	1
A006R26	R:FXD MET FLM 5.23K OHM 1% 1/8W	RN55C5231F	81349	1
A006R27	R:FXD COMP 12K OHM 5% 1/4W	RC07GF123J	81349	1
A006R28	R:FXD COMP 100 OHM 5% 1/4W	RC07GF101J	81349	1
A006R29	R:FXD COMP 1.2K OHM 5% 1/4W	RC07GF122J	81349	1
A006R30	R:FXD COMP 68 OHM 5% 1/4W	RC07GF680J	81349	4
A006R31	R:FXD COMP 2.2 OHM 5% 1/2W	RC20GF2R2J	81349	1
A006R32	R:FXD COMP 6.8 OHM 5% 1/4W	RC07GF6R8J	81349	2
A006R33	R:FXD COMP 68 OHM 5% 1/4W	RC07GF680J	81349	4
A006R34	R:FXD WW .30 OHM 5% 3W	RS-2	91637	1
A006R35	R:FXD COMP 12 OHM 5% 1/4W	RC07GF120J	81349	1
A006R36	R:FXD COMP 270 OHM 5% 1W	RC32GF271J	81349	1
A006R37	R:FXD MET FLM 13K OHM 1% 1/8W	RN55C1302F	81349	1
A006R38	R:VAR CERMET 5K OHM 3/4W	89-PR5K	73138	2

REFERENCE DESIGNATION	DESCRIPTION/ /NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A006R39	R:FXD MET FLM 2.43K OHM 1% 1/8W	RN55C2431F	81349	3
A007	EXTENDER,50 PIN	04-100740-01	EIP	1
A010B1	FAN,115V,50-60 HZ	SP2A2	82877	1
A010J2	RECEPTACLE,AC	AC3G	82389	1
A010S1	SWITCH,(115/230V)	46206LF	82389	1
A010XF1	HOLDER,FUSE: BAYONET KNOB	HKP	71400	1
A101	PC ASSY:CONVERTER CONTROL	04-100844-01	EIP	1
A101C1	C:FXD CER .001 UF	5GA-D10	56289	4
A101C2	C:FXD CER .01 UF	TG-S10	56289	52
A101C3	C:FXD CER .01 UF	TG-S10	56289	52
A101C4	C:FXD CER .0015 UF	1MFD-1-152K	56289	1
A101C5	C:FXD MTL FLM .1UF	C280AE/P100K	73445	4
A101C6	C:FXD CER .01 UF	TG-S10	56289	52
A101C7	C:FXD CER .01 UF	TG-S10	56289	52
A101C8	C:FXD TA ELECT 1.5UF	CS13BE155K	56289	1
A101C9	C:FXD TA ELECT .15UF	150D154X9020A2	56289	1
A101C10	C:FXD TA ELECT 6.8UF 35V	CS13BF685K	56289	6
A101C11	C:FXD CER .01 UF	TG-S10	56289	52
A101C12	C:FXD CER .01 UF	TG-S10	56289	52
A101C13	C:FXD CER .01 UF	TG-S10	56289	52
A101C14	C:FXD CER .01 UF	TG-S10	56289	52
A101C15	C:FXD TA ELECT .47UF	CS13BF474K	56289	1
A101C16	C:FXD CER .01 UF	TG-S10	56289	52
A101C17	C:FXD CER .01 UF	TG-S10	56289	52
A101C18	C:FXD CER .001 UF	5GA-D10	56289	4
A101C19	C:FXD CER .01 UF	TG-S10	56289	52
A101C20	C:FXD CER .01 UF	TG-S10	56289	52
A101C21	C:FXD CER .01 UF	TG-S10	56289	52
A101C22	C:FXD TA ELECT 6.8UF 35V	CS13BF685K	56289	6
A101C23	C:FXD TA ELECT 1.0UF	CS13BF105K	56289	2
A101C24	C:FXD CER .01 UF	TG-S10	56289	52
A101C25	C:FXD CER .01 UF	TG-S10	56289	52
A101C26	C:FXD CER .01 UF	TG-S10	56289	52
A101C27	C:FXD MTL FLM .1UF	C280AE/P100K	73445	4
A101C28	C:FXD CER .01 UF	TG-S10	56289	52
A101C29	C:FXD CER .01 UF	TG-S10	56289	52
A101C30	C:FXD CER .01 UF	TG-S10	56289	52
A101C31	C:FXD MTL FLM .1UF	C280AE/P100K	73445	4
A101C32	C:FXD CER .001 UF	5GA-D10	56289	4
A101C33	C:FXD CER .01 UF	TG-S10	56289	52
A101C34	C:FXD CER .01 UF	TG-S10	56289	52
A101C35	C: FXD MICA S.A.T.	DM-15-XXXJ	72136	2
A101C36	C:FXD CER .01 UF	TG-S10	56289	52
A101C37	C:FXD MTL FLM .1UF	C280AE/P100K	73445	4
A101C38	C:FXD CER .001 UF	5GA-D10	56289	4
A101C39	C: FXD MICA S.A.T.	DM-15-XXXJ	72136	2
A101C40	C:FXD MICA 12PF	DM15-120J	72136	2
A101C41	C:FXD MICA 33PF	DM15-330J	72136	1
A101C42	C:FXD MICA 12PF	DM15-120J	72136	2
A101C43	C:FXD CER .01 UF	TG-S10	56289	52
A101C44	C:FXD CER .01 UF	TG-S10	56289	52
A101C45	C: FXD MICA VAR 5.5-18PF	538-01192A	72982	1
A101C46	C:FXD CER .01 UF	TG-S10	56289	52
A101C47	C:FXD CER .01 UF	TG-S10	56289	52
A101C48	C:FXD CER .01 UF	TG-S10	56289	52
A101C49	C:FXD CER .01 UF	TG-S10	56289	52
A101C50	C:FXD CER .01 UF	TG-S10	56289	52
A101C51	C: FXD MICA VAR 2-8PF	538-01189A	72982	1
A101C52	C:FXD CER .01 UF	TG-S10	56289	52
A101C53	C:FXD MICA 20PF	DM15-200J	72136	2
A101C54	C:FXD MICA 51PF	DM15-510J	72136	1
A101C55	C:FXD MICA 20PF	DM15-200J	72136	2
A101C56	C:FXD CER .01 UF	TG-S10	56289	52
A101C57	C:FXD CER .01 UF	TG-S10	56289	52
A101C58	C:FXD CER .01 UF	TG-S10	56289	52
A101C59	C:FXD MICA 330PF	DM15-331J	72136	2
A101C60	C:FXD MICA 330PF	DM15-331J	72136	2
A101C61	C:FXD CER .01 UF	TG-S10	56289	52
A101C62	C:FXD CER .01 UF	TG-S10	56289	52
A101C63	C:FXD CER .01 UF	TG-S10	56289	52
A101C64	C:FXD CER .01 UF	TG-S10	56289	52
A101C65	C:FXD CER .01 UF	TG-S10	56289	52
A101C66	C:FXD CER .01 UF	TG-S10	56289	52
A101C67	C:FXD CER .01 UF	TG-S10	56289	52
A101C68	C:FXD CER .01 UF	TG-S10	56289	52
A101C69	C:FXD TA ELECT 6.8UF 35V	CS13BF685K	56289	6
A101C70	C:FXD CER .01 UF	TG-S10	56289	52
A101C71	C:FXD CER .01 UF	TG-S10	56289	52
A101C72	C:FXD CER .01 UF	TG-S10	56289	52
A101C73	C:FXD CER .01 UF	TG-S10	56289	52
A101C74	C:FXD CER .01 UF	TG-S10	56289	52
A101C76	C:FXD CER .1 UF 20% 50V	8121M050651199	72982	1
A101C77	C:FXD CER .01 UF	TG-S10	56289	52
A101C78	C:FXD TA ELECT 1.0UF	CS13BF105K	56289	2
A101C79	C:FXD CER .01 UF	TG-S10	56289	52
A101C80	C:FXD TA ELECT 6.8UF 35V	CS13BF685K	56289	6
A101C81	C:FXD CER .01 UF	TG-S10	56289	52
A101C82	C:FXD TA ELECT 6.8UF 35V	CS13BF685K	56289	6

TABLE 8-1

REFERENCE DESIGNATION	DESCRIPTION/ /NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A101C13	C:FXD CER .01 UF	TG-S10	56289	52
A101C14	C:FXD TA ELECT 6.8UF 35V	CS13BF685K	56289	6
A101C15	C:FXD CER .01 UF	TG-S10	56289	52
A101C86	C:FXD CER .01 UF	TG-S10	56289	52
A101CR1	:DIODE ZENER 6.2V	1N827	04713	1
A101CR2	:DIODE	1N4154	04713	5
A101CR3	:DIODE	1N4154	04713	5
A101CR4	:DIODE	1N4154	04713	5
A101CR5	:DIODE	1N4154	04713	5
A101CR6	:DIODE	1N4154	04713	5
A101CR7	:DIODE	1N3064	04713	3
A101CR8	:DIODE ZENER SILVER	1N751A	04713	2
A101CR9	:DIODE HOT CARRIER	FH1100	07263	5
A101CR10	:DIODE	1N4001	04713	2
A101CR11	:DIODE	1N4001	04713	2
A101CR12	:DIODE HOT CARRIER	FH1100	07263	5
A101CR13	:DIODE HOT CARRIER	FH1100	07263	5
A101CR14	:DIODE	1N3064	04713	3
A101CR15	:DIODE,ZENER 8.2V	1N756A	04713	1
A101CR16	:DIODE HOT CARRIER	FH1100	07263	5
A101CR17	:DIODE HOT CARRIER	FH1100	07263	5
A101CR18	:DIODE	1N3064	04713	3
A101CR19	:DIODE ZENER SILVER	1N751A	04713	2
A101IC1	IC: OPER AMPL	LM741CN	27014	12
A101IC2	IC: OPER AMPL	LM741CN	27014	12
A101IC3	:IC QUAD 2 INPUT NAND GATE	DM7400N	27014	5
A101IC4	:IC QUAD 2 INPUT NAND GATE	DM7400N	27014	5
A101IC5	:IC DUAL 4 INPUT NAND GATE	DM7420N	27014	2
A101IC6	:IC DUAL JK MASTER/SLAVE FLIPFLOP	DM7473N	27014	2
A101IC7	:IC DUAL JK MASTER/SLAVE FLIPFLOP	DM7473N	27014	2
A101IC8	:IC BCD DECADE COUNTER	DM8280N		3
A101IC9	:IC BCD DECADE COUNTER	DM8280N		3
A101IC10	:IC BCD DECADE COUNTER	DM8280N	27014	3
A101IC11	:IC DUAL 4 INPUT NAND GATE	DM7420N	27014	2
A101IC12	:IC DUAL COMP	LM711CN	27014	3
A101IC13	:IC DUAL COMP	LM711CN	27014	3
A101IC14	:IC DUAL COMP	LM711CN	27014	3
A101IC15	IC: OPER AMPL	LM741CN	27014	12
A101IC16	IC: OPER AMPL	LM741CN	27014	12
A101IC17	IC: OPER AMPL	LM741CN	27014	12
A101IC18	IC: OPER AMPL	LM741CN	27014	12
A101IC19	IC: OPER AMPL	LM741CN	27014	12
A101IC20	IC: OPER AMPL	LM741CN	27014	12
A101IC21	IC: OPER AMPL	LM741CN	27014	12
A101IC22	:IC DUAL DIFF AMP	CA3049	02735	1
A101IC23	IC: OPER AMPL	LM741CN	27014	12
A101IC24	IC: OPER AMPL	LM741CN	27014	12
A101IC25	IC: OPER AMPL	LM741CN	27014	12
A101IC26	:IC QUAD 2 INPUT NAND GATE	DM7400N	27014	5
A101IC27	:IC QUAD 2 INPUT NAND GATE	DM7400N	27014	5
A101IC28	:IC QUAD 2 INPUT NAND GATE	DM7400N	27014	5
A101K1	:RELAY	RA30201121-03	15636	1
A101L1	:INDUCTOR .1MH	DD-0.10	02735	4
A101L2	:INDUCTOR .1MH	DD-0.10	02735	4
A101L3	:INDUCTOR .1MH	DD-0.10	02735	4
A101L4	:INDUCTOR .1MH	DD-0.10	02735	4
A101L5	:INDUCTOR 1.5MH	4425-9K	82142	1
A101Q1	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q2	:TRANSISTOR NPN SILICON	2N3641	04713	14
A101Q3	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q4	:TRANSISTOR NPN SILICON	2N3641	04713	14
A101Q5	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q6	:TRANSISTOR NPN SILICON	2N3641	04713	14
A101Q7	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q8	:TRANSISTOR NPN SILICON	2N3641	04713	14
A101Q9	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q10	:TRANSISTOR NPN SILICON	2N3641	04713	14
A101Q11	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q12	:TRANSISTOR NPN SILICON	2N3641	04713	14
A101Q13	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q14	:TRANSISTOR NPN SILICON	2N3641	04713	14
A101Q15	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q16	:TRANSISTOR NPN SILICON	2N3641	04713	14
A101Q17	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q18	:TRANSISTOR NPN SILICON	2N3641	04713	14
A101Q19	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q20	:TRANSISTOR NPN SILICON	2N3641	04713	14
A101Q21	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q22	:TRANSISTOR NPN SILICON	2N3641	04713	14
A101Q23	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q24	:TRANSISTOR NPN SILICON	2N3641	04713	14
A101Q25	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q26	:TRANSISTOR NPN SILICON	2N3641	04713	14
A101Q27	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q28	:TRANSISTOR NPN SILICON	2N3641	04713	14
A101Q29	:UJT SILICON	MV4891	04713	1
A101Q30	:TRANSISTOR NPN SILICON	2N4124	04713	35

REFERENCE DESIGNATION	DESCRIPTION/NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A101Q31	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q32	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q33	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q34	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q35	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q36	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q37	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q38	:TRANSISTOR PNP SILICON	2N2904	04713	1
A101Q39	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q40	:PNP SILICON	2N4126	04713	1
A101Q41	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q42	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q43	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q44	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q45	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q46	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q47	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q48	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q49	:PNP SILICON	2N4258	04713	1
A101Q50	:NPN SILICON	2N5179	02735	1
A101Q51	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q52	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q53	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101Q54	:TRANSISTOR NPN SILICON	2N4124	04713	35
A101R1	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R2	R:FXD COMP 16M OHM	RC07GF166J	81349	3
A101R3	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R4	R:FXD COMP 8.2M OHM	RC07GF825J	81349	1
A101R5	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R6	R:FXD COMP 3.9M OHM	RC07GF395J	81349	1
A101R7	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R8	R:FXD COMP 2M OHM 1% 1/2W	RN65D2004F	81349	1
A101R9	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R10	R:FXD COMP 1M OHM 1% 1/4W	RN60D1004F	81349	1
A101R11	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R12	R:FXD COMP 800K OHM .1% 1/4W	MF6C-C-8003B	00008	1
A101R13	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R14	R:FXD COMP 400K OHM .1% 1/4W	MF6C-C-4003B	00008	1
A101R15	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R16	R:FXD COMP 200K OHM .025% 1/4	8E16B200K	05591	1
A101R17	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R18	R:FXD COMP 100K OHM .025% 1/4	8E16B100K	05591	1
A101R19	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R20	R:FXD COMP 80K OHM .025% 1/4	8E16B80K	05591	1
A101R21	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R22	R:FXD COMP 405 OHM .01% 1/4W	8E16A40K	05591	1

REFERENCE DESIGNATION	DESCRIPTION/NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A101R23	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R24	R:FXD COMP 20K OHM .01% 1/4W	8E16A20K	05591	1
A101R25	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R26	R:FXD COMP 10K OHM .01% 1/4W	8E16A10K	05591	1
A101R27	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R28	R:FXD COMP 8K OHM .01% 1/4W	8E16A8K	05591	1
A101R29	R:FXD COMP 3K OHM .1% 1/4W	8E16D3K	05591	5
A101R30	R:FXD COMP 3.3 OHM	RC07GF3R3J	81349	1
A101R31	R:FXD COMP 1.5K OHM	RC07GF152J	81349	2
A101R32	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R33	R:FXD COMP 27K OHM	RC07GF273J	81349	10
A101R34	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R35	R:FXD COMP 27K OHM	RC07GF273J	81349	10
A101R36	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R37	R:FXD COMP 27K OHM	RC07GF273J	81349	10
A101R38	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R39	R:FXD COMP 27K OHM	RC07GF273J	81349	10
A101R40	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R41	R:FXD COMP 27K OHM	RC07GF273J	81349	10
A101R42	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R43	R:FXD COMP 27K OHM	RC07GF273J	81349	10
A101R44	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R45	R:FXD COMP 27K OHM	RC07GF273J	81349	10
A101R46	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R47	R:FXD COMP 27K OHM	RC07GF273J	81349	10
A101R48	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R49	R:FXD COMP 27K OHM	RC07GF273J	81349	10
A101R50	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R51	R:FXD COMP 27K OHM	RC07GF273J	81349	10
A101R52	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R53	R:FXD COMP 22K OHM	RC07GF223J	81349	5
A101R54	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R55	R:FXD COMP 18K OHM	RC07GF183J	81349	1
A101R56	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R57	R:FXD COMP 13K OHM	RC07GF133J	81349	1
A101R58	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R59	R:FXD COMP 10K OHM	RC07GF103J	81349	48
A101R60	R:FXD COMP 8K OHM .1% 1/4W	8E16D8K	05591	2
A101R61	R:FXD COMP 8K OHM .1% 1/4W	8E16D3K	05591	2
A101R62	R:FXD COMP 3.9K OHM	RC07GF392J	81349	2
A101R63	R:FXD COMP 750 OHM 1% 1/8W	RN55C7500F	81349	1
A101R64	R:FXD COMP 22K OHM	RC07GF223J	81349	5
A101R65	R:FXD COMP 1K OHM	RC07GF102J	81349	13
A101R66	R:FXD COMP 1K OHM	RC07GF102J	81349	13
A101R67	R:FXD COMP 12 OHM	RC07GF120J	81349	1
A101R68	R:FXD COMP 620 OHM	RC07GF621J	81349	2
A101R69	R:FXD COMP 100 OHM	RC07GF101J	81349	7
A101R70	R:FXD COMP 2.4K OHM	RC07GF242J	81349	5

TABLE 8-1

TABLE 8-1

REFERENCE DESIGNATION	DESCRIPTION/ /NOMENCLATURE		MANUFACTURER PART NUMBER	MFR	AQ
A101R71	R:FXD COMP	2.2M OHM	RC07GF225J	81349	1
A101R72	R:VARIABLE	10K OHM .1% 1/4W	89-PR10K	80294	2
A101R73	R:FXD COMP	22M OHM	RC07GF226J	81349	3
A101R74	R:FXD COMP	22M OHM	RC07GF226J	81349	3
A101R75	R:FXD COMP	22M OHM	RC07GF226J	81349	3
A101R76	R:FXD COMP	16M OHM	RC07GF166J	81349	3
A101R77	R:FXD COMP	16M OHM	RC07GF166J	81349	3
A101R78	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R79	R:FXD COMP	5.6 OHM	RC07GF5R6J	81349	10
A101R80	R:FXD COMP	5.6 OHM	RC07GF5R6J	81349	10
A101R81	R:FXD COMP	5.6 OHM	RC07GF5R6J	81349	10
A101R82	R:FXD COMP	5.6 OHM	RC07GF5R6J	81349	10
A101R83	R:FXD COMP	5.6 OHM	RC07GF5R6J	81349	10
A101R84	R:FXD COMP	5.6 OHM	RC07GF5R6J	81349	10
A101R85	R:FXD COMP	1K OHM	RC07GF102J	81349	13
A101R86	R:FXD COMP	1K OHM	RC07GF102J	81349	13
A101R87	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R88	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R89	R:FXD COMP	5.6 OHM	RC07GF5R6J	81349	10
A101R90	R:FXD COMP	3.3K OHM	RC07GF332J	81349	7
A101R91	R:FXD COMP	3.3K OHM	RC07GF332J	81349	7
A101R92	R:FXD COMP	6.8K OHM	RC07GF682J	81349	2
A101R93	R:FXD COMP	6.8K OHM	RC07GF682J	81349	2
A101R94	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R95	R:FXD COMP	5.6 OHM	RC07GF5R6J	81349	10
A101R96	R:FXD COMP	1K OHM	RC07GF102J	81349	13
A101R97	R:FXD COMP	43K OHM	RC07GF433J	81349	1
A101R98	R:FXD COMP	4.7K OHM	R707GF472J	81349	8
A101R99	R:FXD COMP	4.7K OHM	R707GF472J	81349	8
A101R100	R:FXD COMP	22K OHM	RC07GF223J	81349	5
A101R101	R:FXD COMP	200K OHM	RC07GF204J	81349	1
A101R102	R:FXD COMP	22K OHM	RC07GF223J	81349	5
A101R103	R:FXD COMP	100 OHM	RC07GF101J	81349	7
A101R104	R:VARIABLE	1K OHM .1% 1/4W	89-PR1K	80294	9
A101R105	R:VARIABLE	1K OHM .1% 1/4W	89-PR1K	80294	9
A101R106	R:FXD COMP	560 OHM	RC07GF561J	81349	6
A101R107	R:FXD COMP	2.4K OHM	RC07GF242J	81349	6
A101R108	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R109	R:FXD COMP	4.22K OHM 1% 1/8W	RN55C4221F	81349	4
A101R110	R:VARIABLE	100- OHM	89-PR100K	80294	5
A101R111	R:VARIABLE	1K OHM .1% 1/4W	89-PR1K	80294	9
A101R112	R:VARIABLE	1K OHM .1% 1/4W	89-PR1K	80294	9
A101R113	R:FXD COMP	560 OHM	RC07GF561J	81349	6
A101R114	R:FXD COMP	2.4K OHM	RC07GF242J	81349	6
A101R115	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R116	R:FXD COMP	4.22K OHM 1% 1/8W	RN55C4221F	81349	4
A101R117	R:VARIABLE	100- OHM	89-PR100K	80294	5
A101R118	R:FXD COMP	4.7K OHM	RC07GF472J	81349	8

REFERENCE DESIGNATION	DESCRIPTION/ /NOMENCLATURE		MANUFACTURER PART NUMBER	MFR	AQ
A101R119	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R120	R:FXD COMP	3.3K OHM	RC07GF332J	81349	7
A101R121	R:FXD COMP	22K OHM	RC07GF223J	81349	5
A101R122	R:FXD COMP	560 OHM	RC07GF561J	81349	6
A101R123	R:FXD COMP	1.5K OHM	RC07GF152J	81349	2
A101R124	R:FXD COMP	1K OHM	RC07GF102J	81349	13
A101R125	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R126	R:VARIABLE	1K OHM .1% 1/4W	89-PR1K	80294	9
A101R127	R:VARIABLE	1K OHM .1% 1/4W	89-PR1K	80294	9
A101R128	R:FXD COMP	560 OHM	RC07GF561J	81349	6
A101R129	R:FXD COMP	2.4K OHM	RC07GF242J	81349	6
A101R130	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R131	R:FXD COMP	4.22K OHM 1% 1/8W	RN55C4221F	81349	4
A101R132	R:VARIABLE	100- OHM	89-PR100K	80294	5
A101R133	R:FXD COMP	180 OHM 1W	RC20GF181J	81349	1
A101R134	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R135	R:FXD COMP	2.4K OHM	RC07GF242J	81349	6
A101R136	R:FXD COMP	4.7K OHM	RC07GF472J	81349	8
A101R137	R:FXD COMP	4.7K OHM	RC07GF472J	81349	8
A101R138	R:FXD COMP	1K OHM	RC07GF102J	81349	13
A101R139	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R140	R:FXD COMP	620 OHM	RC07GF621J	81349	2
A101R141	R:FXD COMP	178K OHM 1% 1/8W	RN55C1783F	81349	5
A101R142	R:FXD COMP	100 OHM 5% 1/4W	RC07GF101J	81349	7
A101R143	R:VARIABLE	200 OHM	89-PR200	80294	3
A101R144	R:FXD COMP	5.62K OHM 1% 1/8W	RN55D5621F	81349	3
A101R145	R:FXD COMP	1.00K OHM 1% 1/8W	RN55D1001F	81349	4
A101R146	R:FXD COMP	4.7M OHM	RC07GF475J	81349	2
A101R147	R:FXD COMP	1.00K OHM 1% 1/8W	RN55D1001F	81349	4
A101R148	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R149	R:FXD COMP	2.4K OHM	RC07GF242J	81349	6
A101R150	R:FXD COMP	4.7K OHM	RC07GF472J	81349	8
A101R151	R:FXD COMP	4.7K OHM	RC07GF472J	81349	8
A101R152	R:FXD COMP	4.7K OHM	RC07GF472J	81349	8
A101R153	R:FXD COMP	3K OHM .1% 1/4W	8E16D3K	05591	5
A101R154	R:FXD COMP	3K OHM .1% 1/4W	8E16D3K	05591	5
A101R155	R:VARIABLE	200 OHM	89-PR200	80294	3
A101R156	R:FXD COMP	1K OHM	RC07GF102J	81349	13
A101R157	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R158	R:FXD COMP	3.09K OHM 1% 1/8W	RN55C3091F	81349	2
A101R159	R:VARIABLE	1K OHM .1% 1/4W	89-PR1K	80294	9
A101R160	R:FXD COMP	8.45K OHM 1% 1/8W	RN55D8451F	81349	2
A101R161	R:FXD COMP	330 OHM	RC07GF331J	81349	4
A101R162	R:FXD COMP	3K OHM .1% 1/4W	8E16D3K	05591	5
A101R163	R:FXD COMP	3K OHM .1% 1/4W	8F16D3K	05591	5
A101R164	R:VARIABLE	200 OHM	89-PR200	80294	3
A101R165	R:FXD COMP	1K OHM	RC07GF102J	81349	13
A101R166	R:FXD COMP	750 OHM 1% 1/8W	RN55D7500F	81349	1

REFERENCE DESIGNATION	DESCRIPTION/NOMENCLATURE		MANUFACTURER PART NUMBER	MFR	AQ
A101R167	R:VARIABLE	1K OHM .1% 1/4W	89-PR1K	80294	9
A101R168	R:FXD COMP	34.8K OHM 1% 1/8W	RN55C3482F	81349	1
A101R169	R:FXD COMP	330 OHM	RC07GF331J	81349	4
A101R170	R:FXD COMP	10 OHM 3W	RS28	91637	1
A101R171	R: FXD COMP	10.0K OHM 1% 1/8W	RN55C1002F	81349	2
A101R172	R:FXD COMP	4.22K OHM 1% 1/8W	RN55C4221F	81349	4
A101R173	R:VARIABLE	1K OHM .1% 1/4W	89-PR1K	80294	9
A101R174	R:FXD COMP	1K OHM	RC07GF102J	81349	13
A101R175	R:FXD COMP	5.11K OHM 1% 1/8W	RN55D5111F	81349	1
A101R176	R:FXD COMP	511 OHM 1% 1/8W	RN55D5110F	81349	1
A101R177	R:VARIABLE	50K OHM	89-PR50K	80294	1
A101R178	R:FXD COMP	10.0K OHM 1% 1/8W	RN55C1002F	81349	2
A101R179	R:FXD COMP	330 OHM	RC07GF331J	81349	4
A101R180	R:FXD COMP	22 OHM	RC07GF220J	81349	2
A101R181	R:FXD COMP	47 OHM	RC07GF470J	81349	1
A101R182	R:FXD COMP	22 OHM	RC07GF220J	81349	2
A101R183	R:FXD COMP	51 OHM	RC07GF510J	81349	5
A101R184	R:FXD COMP	15K OHM	RC07GF153J	81349	2
A101R185	R:FXD COMP	3.9K OHM	RC07GF392J	81349	2
A101R186	R:FXD COMP	SAT 5.6 OHM NOM	RC07GFXXXJ	81349	1
A101R187	R:FXD COMP	270 OHM	RC07GF271J	81349	1
A101R188	R:FXD COMP	100 OHM	RC07GF101J	81349	7
A101R189	R:FXD COMP	220 OHM	RC07GF221J	81349	1
A101R190	R:FXD COMP	100 OHM	RC07GF101J	81349	7
A101R191	R:FXD COMP	3.6K OHM	RC07GF362J	81349	2
A101R192	R:FXD COMP	2.2K OHM	RC07GF222J	81349	5
A101R193	R:FXD COMP	51 OHM	RC07GF510J	81349	5
A101R194	R:FXD COMP	51 OHM	RC07GF510J	81349	5
A101R195	R:FXD COMP	1.0K OHM 1% 1/4W	RN60D1001F	81349	1
A101R196	R:FXD COMP	22.1 OHM 1% 1/8W	RN55D22R1F	81349	1
A101R197	R:VARIABLE	100 OHM	89-PR100	80294	2
A101R198	R:FXD COMP	390 OHM	RC07GF391J	81349	1
A101R199	R:FXD COMP	3.09K OHM 1% 1/8W	RN55C3091F	81349	2
A101R200	R:FXD COMP	30K OHM	RC07GF303J	81349	1
A101R201	R:FXD COMP	680 OHM	RC07GF681J	81349	2
A101R202	R:FXD COMP	178K OHM 1% 1/8W	RN55C1783F	81349	5
A101R203	R:FXD COMP	178K OHM 1% 1/8W	RN55C1783F	81349	5
A101R204	R:FXD COMP	5.6 OHM	RC07GF5R6J	81349	10
A101R205	R:FXD COMP	3.3K OHM	RC07GF332J	81349	7
A101R206	R:FXD COMP	2.2K OHMR	RC07GF222J	81349	5
A101R207	R:FXD COMP	1K OHM	RC07GF102J	81349	13
A101R208	R:FXD COMP	1K OHM	RC07GF102J	81349	13
A101R209	R:FXD COMP	2.2K OHM	RC07GF222J	81349	5
A101R210	R:FXD COMP	470 OHM	RC07GF471J	81349	2
A101R211	R:FXD COMP	680 OHM	RC07GF681J	81349	2
A101R212	R:FXD COMP	3.6K OHM	RC07GF362J	81349	2
A101R213	R:FXD COMP	51 OHM	RC07GF510J	81349	5
A101R214	R:FXD COMP	51 OHM	RC07GF510J	81349	5

REFERENCE DESIGNATION	DESCRIPTION/NOMENCLATURE		MANUFACTURER PART NUMBER	MFR	AQ
A101R215	R:FXD COMP	470 OHM	RC07GF471J	81349	2
A101R216	R:FXD COMP	130 OHM	RC07GF131J	81349	1
A101R217	R:FXD COMP	374 OHM 1% 1/8W	RN55D3740F	81349	1
A101R218	R:VARIABLE	10K OHM .1% 1/4W	89-PR10K	80294	2
A101R219	R:FXD COMP	49.9K OHM 1% 1/8W	RN55D4992F	81349	1
A101R220	R:FXD COMP	1.00K OHM 1% 1/8W	RN55D1001F	81349	4
A101R221	R:FXD COMP	1.00K OHM 1% 1/8W	RN55D1001F	81349	4
A101R222	R:FXD COMP	178K OHM 1% 1/8W	RN55C1783F	81349	5
A101R223	R:FXD COMP	178K OHM 1% 1/8W	RN55C1783F	81349	5
A101R224	R:FXD COMP	5.6 OHM	RC07GF5R6J	81349	10
A101R225	R:FXD COMP	3.3K OHM	RC07GF332J	81349	7
A101R226	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R227	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R228	R:FXD COMP	68K OHM	RC07GF683J	81349	1
A101R229	R:VARIABLE	100- OHM	89-PR100K	80294	5
A101R230	R:FXD COMP	100K OHM 1% 1/8W	RN55D1003F	81349	4
A101R231	R:FXD COMP	100K OHM 1% 1/8W	RN55D1003F	81349	4
A101R232	R:FXD COMP	15M OHM 5% 1/4W	RC07GF156J	81349	1
A101R233	R:FXD COMP	8.45K OHM 1% 1/8W	RN55D8451F	81349	2
A101R234	R:VARIABLE	100- OHM	89-PR100K	80294	5
A101R235	R:FXD COMP	100K OHM 1% 1/8W	RN55D1003F	81349	4
A101R236	R:FXD COMP	100K OHM 1% 1/8W	RN55D1003F	81349	4
A101R237	R:FXD COMP	15K OHM	RC07GF153J	81349	2
A101R238	R:FXD COMP	330 OHM	RC07GF331J	81349	4
A101R239	R:FXD COMP	3.3K OHM	RC07GF332J	81349	7
A101R240	R:FXD COMP	100 OHM	RC07GF101J	81349	7
A101R241	R:FXD COMP	560 OHM	RC07GF561J	81349	6
A101R242	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R243	R:FXD COMP	2.2K OHM	RC07GF222J	81349	5
A101R244	R:FXD COMP	3.3K OHM	RC07GF332J	81349	7
A101R245	R:FXD COMP	18K OHM NOM.	RC07GFXXXJ	81349	2
A101R246	R:FXD COMP	619 OHM 1% 1/8W	RN60D6190F	81349	1
A101R247	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R248	R:FXD COMP	1K OHM	RC07GF102J	81349	13
A101R249	R:FXD COMP	100 OHM	RC07GF101J	81349	7
A101R250	R:FXD COMP	5.62K OHM 1% 1/8W	RN55D5621F	81349	3
A101R251	R:VARIABLE	100 OHM	89-PR100	80294	2
A101R252	R:FXD COMP	5.62K OHM 1% 1/8W	RN55D5621F	81349	3
A101R253	R:FXD COMP	4.7M OHM	RC07GF475J	81349	2
A101R254	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A101R255	R:FXD COMP	2.2K OHM	RC07GF222J	81349	5
A101R256	R:FXD COMP	560 OHM	RC07GF561J	81349	6
A101R257	R:FXD COMP	10K OHM	RC07GF103J	81349	48
A102	ASSY:HIGH BAND COMB GEN. (350B)		04-100404-01	EIP	1
A102	ASSY:HIGH BAND COMB GEN. (351B)		04-100404-02	EIP	1
A103	ASSY:COUPLER (350B)		54-100403-01	EIP	1

REFERENCE DESIGNATION	DESCRIPTION/ /NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A103	ASSY:COUPLER (351B)	54-100403-02	EIP	1
A104	ASSY:HIGH GAIN VIDEO AMPLIFIER	04-100407-01	EIP	1
A105	ASSY:DETECTOR (350B)	04-100831-01	EIP	1
A105	ASSY:DETECTOR (351B)	04-100831-02	EIP	1
A106	ASSY:DUAL POWER AMPLIFIER	04-100411-01	EIP	1
A107	ASSY:MIXER/VIDEO AMPLIFIER	04-100412-01	EIP	1
A109	ASSY:LOW BAND COMB GENERATOR	04-100413-01	EIP	1
A132	ASSY:PHASE LOCKED OSCILLATOR	04-100850-01	EIP	1
A133	ASSY:X5 MULTIPLIER	04-100812-01	EIP	1
AT1	TERMINATION,50 OHM	8018-6001	95077	1
DS1	LAMP,SOLID STATE	5082-4403	28480	1
E1	POWER CORD:115/230VAC 3-WIRE	17258	70903	1
J1	CONNECTOR:BNC PANEL MOUNT	UG-1094A/U	81349	2
J2	CONNECTOR:BNC PANEL MOUNT	UG-1094A/U	81349	2
J3	ATTENUATOR:3DB PANEL MOUNT(350B)	51-100838-01	EIP	1
J3	ATTENUATOR:3DB PANEL MOUNT(351B)	2818-1	93459	1
J4	CONNECTOR,PC EDGE,50 PIN	50-50A-30	71785	4
J5	CONNECTOR,PC EDGE,50 PIN	50-50A-30	71785	4
J6	CONNECTOR,PC EDGE,50 PIN	50-50A-30	71785	4
J7	CONNECTOR,PC EDGE,50 PIN	50-50A-30	71785	4
MP1	FRONT PANEL (350B)	82-100726-01	EIP	1
MP1	FRONT PANEL (351B)	82-100726-02	EIP	1
MP2	SIDE COVER,LEFT	89-100778-01	EIP	1
MP3	SIDE COVER,RIGHT,VENTED	89-100778-02	EIP	1
MP4	TOP COVER	89-100363-01	EIP	1
MP5	BOTTOM COVER	89-100375-01	EIP	1
MP6	COVER,50 PIN CONNECTOR	82-100384-01	EIP	1
MP7	WINDOW,POLAROID	87-100738-01	EIP	1
MP8	SHIELD,SAFETY	87-100792-01	EIP	1
MP9	BAIL,12 INCH WITH MOUNTING FEET	M6002	21604	1
MP10	KNOB,LEVER SWITCH	0370-0432	28480	1
MP11	KNOB,1/4 SHAFT,WITH POINTER	SS50L-2BLK	21604	1
MP12	OPTION KIT: RACK MOUNTING	82-100460-01	EIP	1
MP13	FILTER,AIR	87-100795-01	EIP	1
MP13	HOLDER,AIR FILTER	82-100723-01	EIP	1
Q1	TRANSISTOR,POWER,NPN S1	40613	02735	2
Q2	TRANSISTOR,POWER,NPN S1	40613	02735	2
R1	R:FXD WW 4 OHM 1% (10PPM) 50W	HT-50	12463	1
R2	R:VAR, PANEL MOUNT,10KOHM,15 TURN	3059J-1-103M	80294	1
S1	SWITCH/POT(250K):SAMPLE RATE	35-100397-01	EIP	1
S2	SWITCH:6 STATION PUSHBUTTON	6XF15FM-2U/EE	0000A	1
S3	SWITCH:SLIDE,2 POLE-2 POSITION	G126	79727	1
S4	SWITCH:PUSHBUTTON,MOM. CONT.,SPST	P8121	09353	1
S5	SWITCH:PUSHBUTTON,MOM. CONT.,SPST	P8121	09353	1
S6	SWITCH:TOGGLE,SPDT	7101H	09353	1
S7	SWITCH:LEVER,3POS.,5 POLE	35-100563-01	EOP	1
W1	CABLE ASSY:.085 SEMI-RIGID (350B)	06-100541-01	EIP	1
W1	CABLE ASSY:.085 SEMI-RIGID (351B)	06-100543-01	EIP	1
W2	CABLE ASSY:.085 SEMI-RIGID (350B)	06-100544-01	EIP	1
W2	CABLE ASSY:.085 SEMI-RIGID (351B)	06-100542-01	EIP	1
W3	CABLE ASSY:RG-188U	06-100793-02	EIP	1
W4	CABLE ASSY:RG-188U	06-100546-01	EIP	1
W5	CABLE ASSY:RG-188U	06-100490-02	EIP	2
W6	CABLE ASSY:RG-188U	06-100490-02	EIP	2
W7	CABLE ASSY:RG-188U	69-1220-138	98291	2
W8	CABLE ASSY:RG-188U	69-1220-198	98291	2
W9	CABLE ASSY:RG-188U	06-100490-01	EIP	1
W10	CABLE ASSY:RG-188U	06-100794-01	EIP	1
W11	CABLE ASSY:RG-188U	06-100793-01	EIP	1
W12	CABLE ASSY:14 PIN DIP	1P14-4T12-1	91506	1

SECTION IX

SCHEMATIC DIAGRAMS AND COMPONENT LOCATIONS

9-1. GENERAL

9-2. Interconnection diagrams in this manual show electrical circuit operation and are not intended to serve as wiring diagrams. Schematic presentations are grouped by individual printed circuit board and module assemblies. Schematic equivalents for integrated circuits used in the Autohet converters are shown in Figure 9-24.

9-3. Component procurement information and specific component descriptions are included in Section VIII - Replaceable Parts. The complete reference designation for any specific part includes the assembly reference designation as its prefix.

9-4. Refer to page 8-1 for information on how to order parts. A listing of Reference Designations and Abbreviations used in this manual may be found in Section VIII.

9-5. Unless otherwise specified, the following notes apply to the diagrams in this section:

a. Resistance values are in ohms.

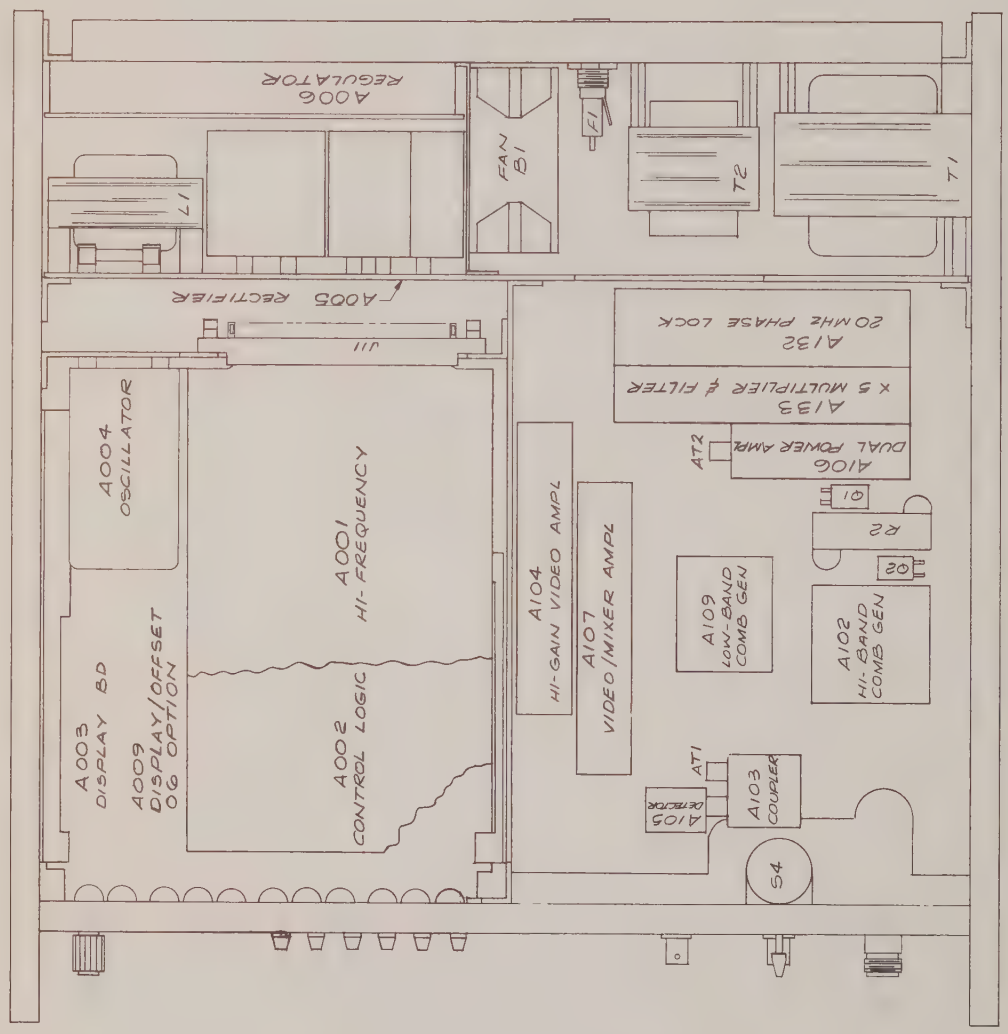
b. Capacitance values are in microfarads.

c. Inductance values are in microhenries.

d. indicates front panel control.

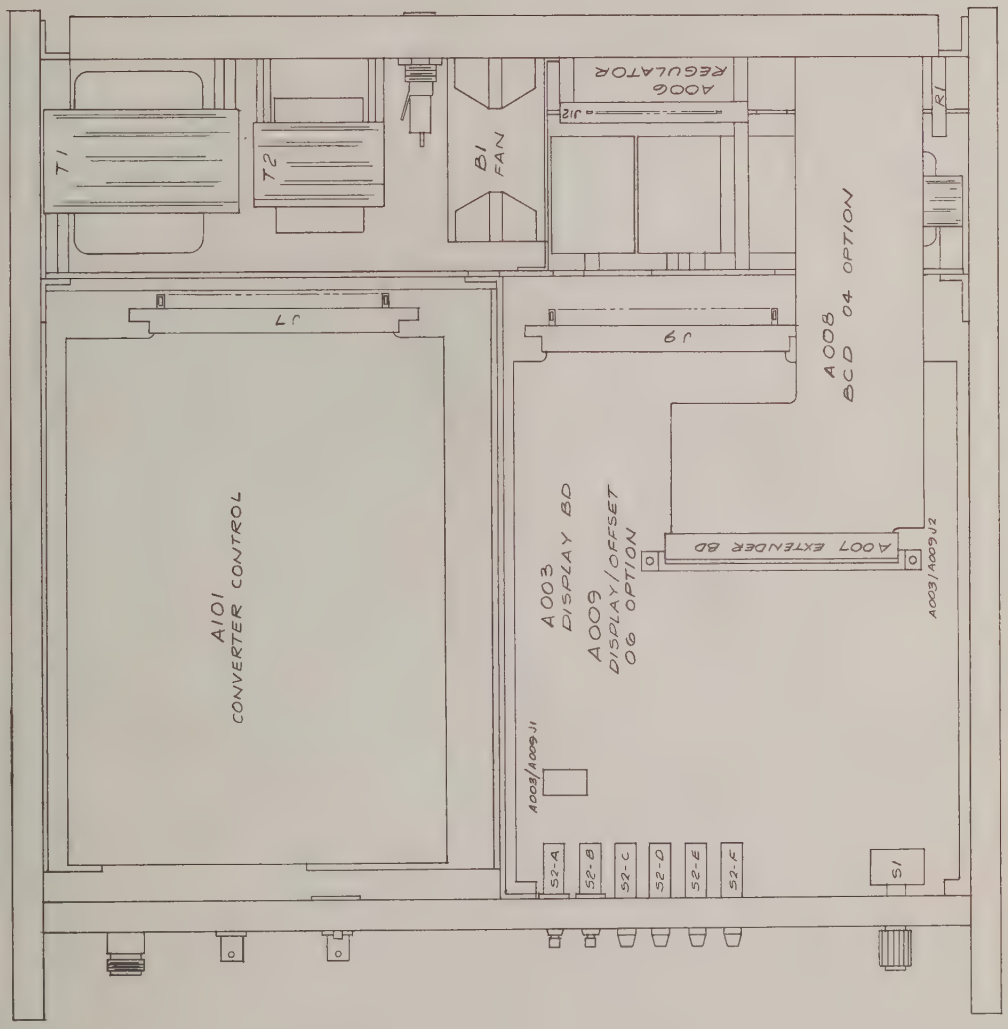
e. indicates rear panel control.

f. Wire colors are for reference only to facilitate troubleshooting.



TOP VIEW
ASSEMBLY LOCATOR
MODEL 350B/351B

BOTTOM VIEW
ASSEMBLY LOCATOR
MODEL 350B/351B



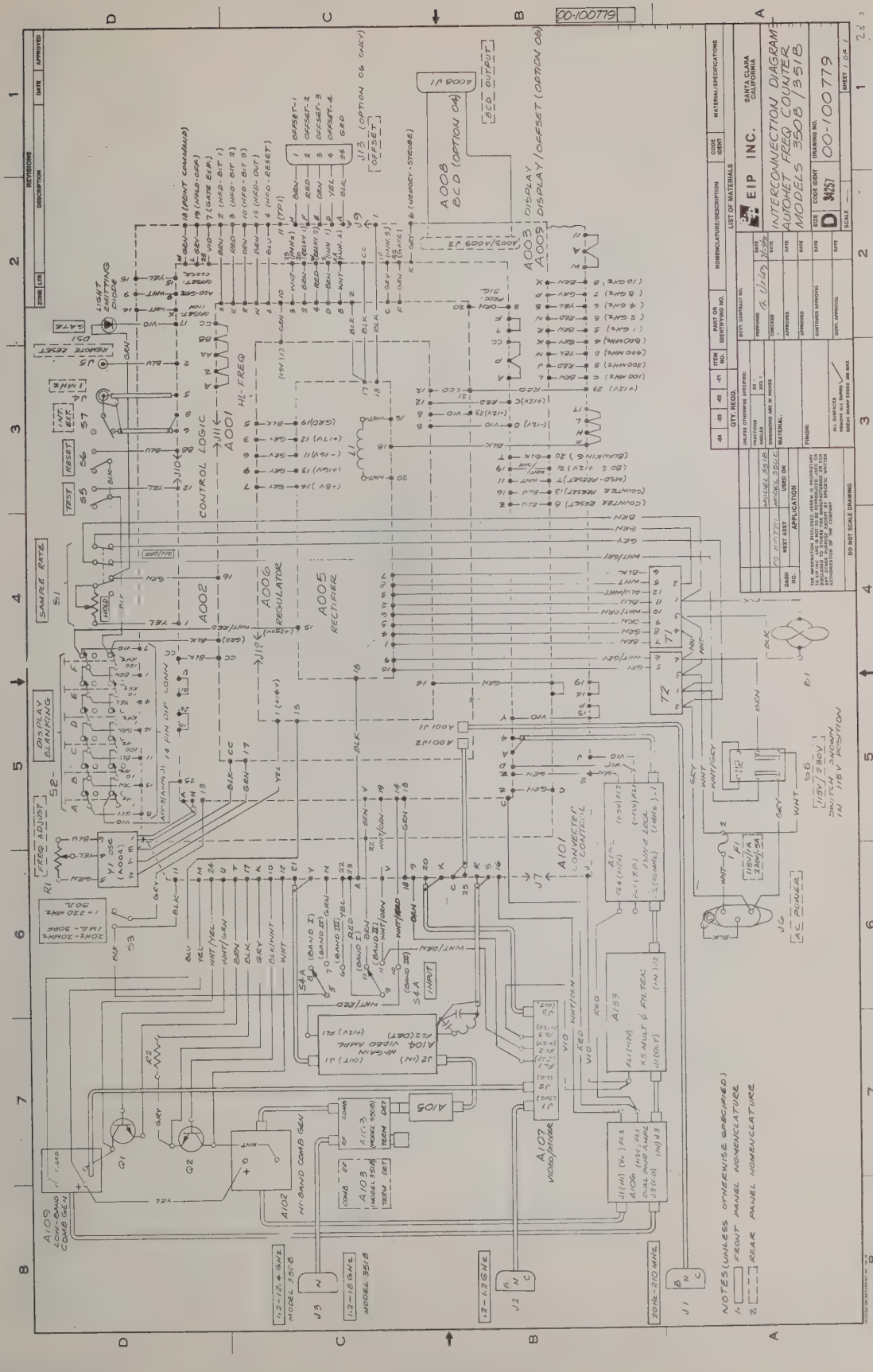

00-100779
EIP INC.
SANTA CLARA CALIFORNIA
INTERCONNECTION DIAGRAM
AUTONET FREQ COUNTER
MODELS 350B/351B
CODE IDENT D 34257
DRAWING NO. 00-100779
SIZE D
SCALE —
SHEET 1 OF 1
A001 HI-FREQ CONTROL LOGIC
A002 SAMPLE RATE
A003 A009 DISPLAY/OFFSET (OPTION 06)
A004 REGULATOR
A005 RECTIFIER
A006 DISPLAY/BLANKING
A008 BCD (OPTION 04)
A008 U1 BCD OUTPUT
A010 LOW BAND COMB GEN
A101 CONNECTER/J CONTROL
A102 HI-BAND COMB GEN
A103 (MODEL 351B) TERM DET
A104 VIDEO AMPL
A105
A106 DUAL MULT & FILTER
A107 VIDEO/MIXER
A133 X5 MULT & FILTER
J13 (OPTION 06 ONLY) OFFSET
OFFSET-1
OFFSET-2
OFFSET-3
OFFSET-4
GND
LIGHT EMITTING DIODE
REMOTE RESET
TEST
RESET
SAMPLE RATE
FREQ ADJUST
DISPLAY BLANKING
ON/OFF
20MHz-30MHz IMAG-300K
1-220 MHz 30K
1-2GHz MODEL 350B
2-3.2GHz
2GHz-3.2GHz
AC POWER
115V/230V SWITCH SHOWN IN 115V POSITION
NOTES (UNLESS OTHERWISE SPECIFIED)
1. FRONT PANEL NOMENCLATURE.
2. REAR PANEL NOMENCLATURE.
LIST OF MATERIALS
DO NOT SCALE DRAWING

FIGURE 9-3

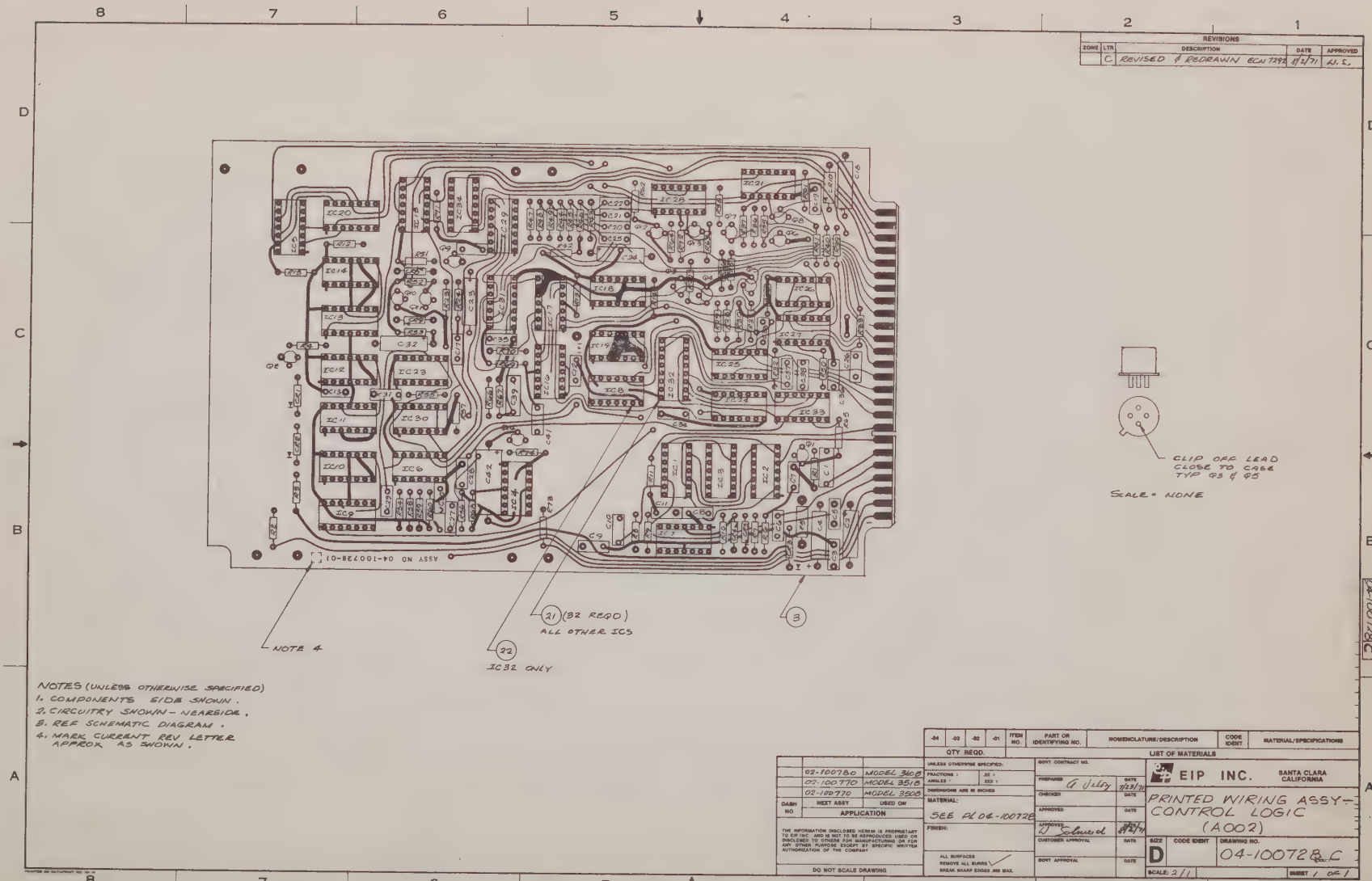

REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
C REVISED & REDRAWN ECN 7292 11/2/71 W. S.
ASSY NO 04-100728-01
CLIP OFF LEAD CLOSE TO CASE TYP Q3 & Q5
SCALE - NONE
NOTE 4
21 (32 REQD) ALL OTHER ICS
22 IC32 ONLY
3
NOTES (UNLESS OTHERWISE SPECIFIED)
1. COMPONENTS SIDE SHOWN.
2. CIRCUITRY SHOWN - NEARSIDE.
3. REF SCHEMATIC DIAGRAM.
4. MARK CURRENT REV LETTER APPROX AS SHOWN.
LIST OF MATERIALS
EIP INC. SANTA CLARA CALIFORNIA
PRINTED WIRING ASSY - CONTROL LOGIC (A002)
04-100728 Rev C
SIZE D
SCALE: 2/1
SHEET 1 OF 1
02-100780 MODEL 360B
02-100770 MODEL 351B
02-100770 MODEL 350B
SEE PL 04-100728
DO NOT SCALE DRAWING

Fig 9-4

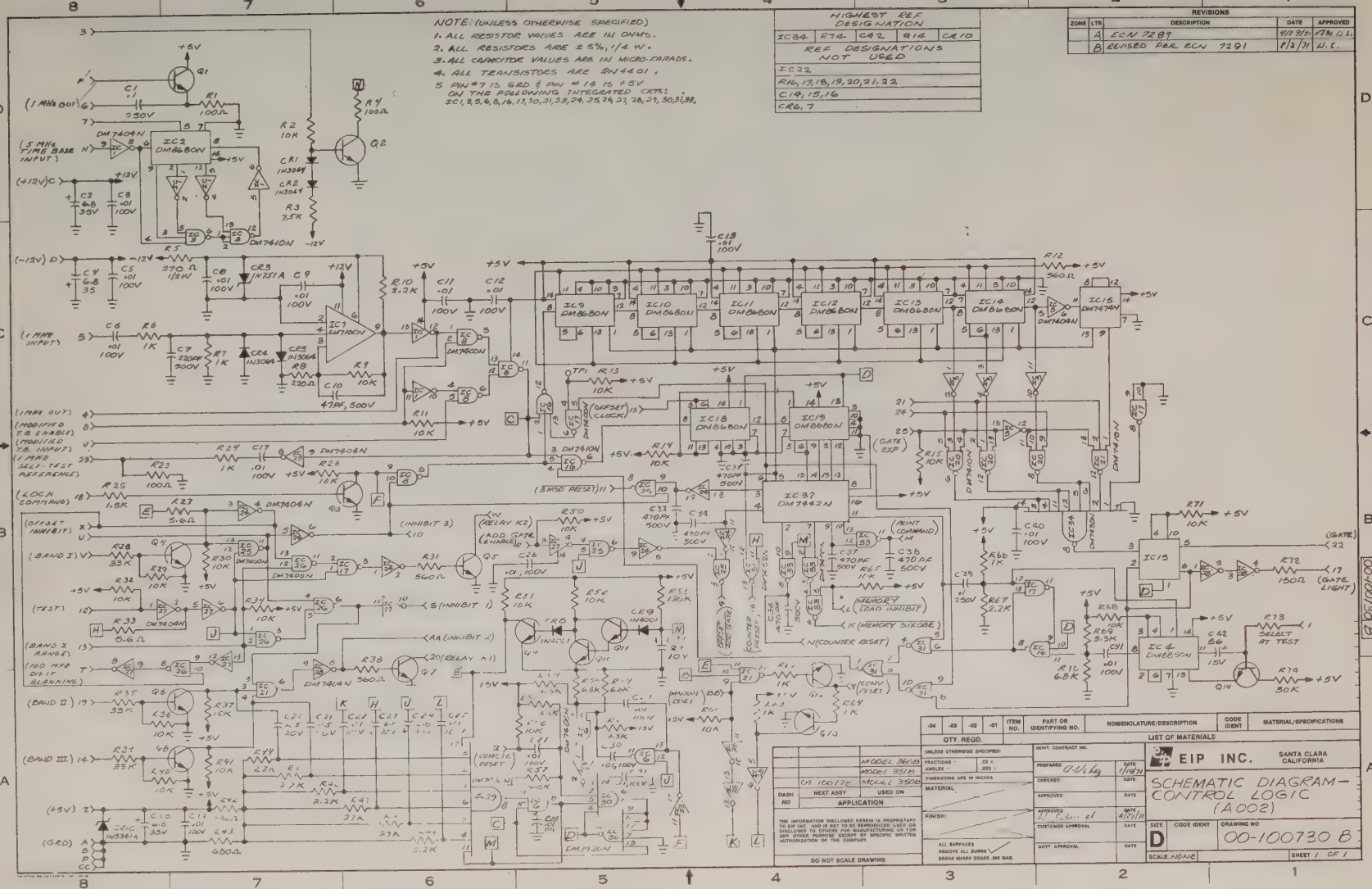

NOTE: (UNLESS OTHERWISE SPECIFIED)
1. ALL RESISTOR VALUES ARE IN OHMS.
2. ALL RESISTORS ARE ±5%, 1/4 W.
3. ALL CAPACITOR VALUES ARE IN MICRO-FARADS.
4. ALL TRANSISTORS ARE 2N4401.
5 PIN #7 IS GRD & PIN #14 IS +5V ON THE FOLLOWING INTEGRATED CKTS: IC1, 8, 5, 6, 8, 16, 17, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33.
HIGHEST REF DESIGNATION
IC34 R74 C92 Q14 CR10
REF DESIGNATIONS NOT USED
IC22
R16, 17, 18, 19, 20, 21, 22
C14, 15, 16
CR6, 7
REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
A ECN 7289 4/27/71 TTH W.L.
B REVISED PER ECN 7291 8/2/71 W.C.
(1 MHz OUT)
(5 MHz TIME BASE INPUT)
(+12V)
(-12V)
(1 MHz INPUT)
(1 MHz OUT)
(MODIFIED T.B. ENABLE)
(MODIFIED T.B. INPUT)
(1 MHz SELF-TEST REFERENCE)
(LOCK COMMAND)
(OFFSET INHIBIT)
(BAND I)
(TEST)
(BAND I RANGE)
(100 MHz DECADE BLANKING)
(BAND II)
(BAND III)
(+5V)
(GRD)
(3 MSD PRESET)
(INHIBIT 3)
(RELAY K2)
(ADD GATE ENABLE)
(INHIBIT 1)
(INHIBIT 2)
(RELAY K1)
(OFFSET CLOCK)
(GATE EXP)
(PRINT COMMAND)
(MEMORY LOAD INHIBIT)
(MEMORY STROBE)
(COUNTER RESET)
(CONV RESET)
(GATE)
(GATE LIGHT)
SELECT AT TEST
DM7404N
DM74H04N
DM74H10N
DM74H20N
DM7420N
DM7430N
DM7474N
DM74L04N
DM74L10N
DM74L20N
DM74L30N
DM74L42N
DM74L90N
DM74L93N
DM8680N
DM8681N
DM8690N
LM710CN
1N751A
1N3064
1N3600
1N3604
1N3605
2N4401
2N5210
2N5508
2N5509
MODEL 3626B
MODEL 3516B
MODEL 3508
CR 100172E
NEXT ASSY
USED ON
APPLICATION
DO NOT SCALE DRAWING
THE INFORMATION DISCLOSED HEREIN IS PROPRIETARY TO EIP INC. AND IS NOT TO BE REPRODUCED, USED OR DISCLOSED TO OTHERS FOR MANUFACTURING OR FOR ANY OTHER PURPOSE EXCEPT BY SPECIFIC WRITTEN AUTHORIZATION OF THE COMPANY
LIST OF MATERIALS
-04 -03 -02 -01 ITEM NO. PART OR IDENTIFYING NO. NOMENCLATURE/DESCRIPTION CODE IDENT MATERIAL/SPECIFICATIONS
QTY. REQD.
UNLESS OTHERWISE SPECIFIED:
FRACTIONS ± DECIMALS ± ANGLES ±
DIMENSIONS ARE IN INCHES
MATERIAL
FINISH:
ALL SURFACES REMOVE ALL BURRS BREAK SHARP EDGES .005 MAX.
GOVT. CONTRACT NO.
PREPARED D.U. Ley 1/19/71
CHECKED
APPROVED
APPROVED C. C. Lee 4/19/71
CUSTOMER APPROVAL
GOVT. APPROVAL
EIP INC. SANTA CLARA CALIFORNIA
SCHEMATIC DIAGRAM— CONTROL LOGIC (A002)
SIZE D CODE IDENT DRAWING NO 00-100730 B
SCALE: NONE SHEET 1 OF 1
00-100730 B

FIGURE 9-5

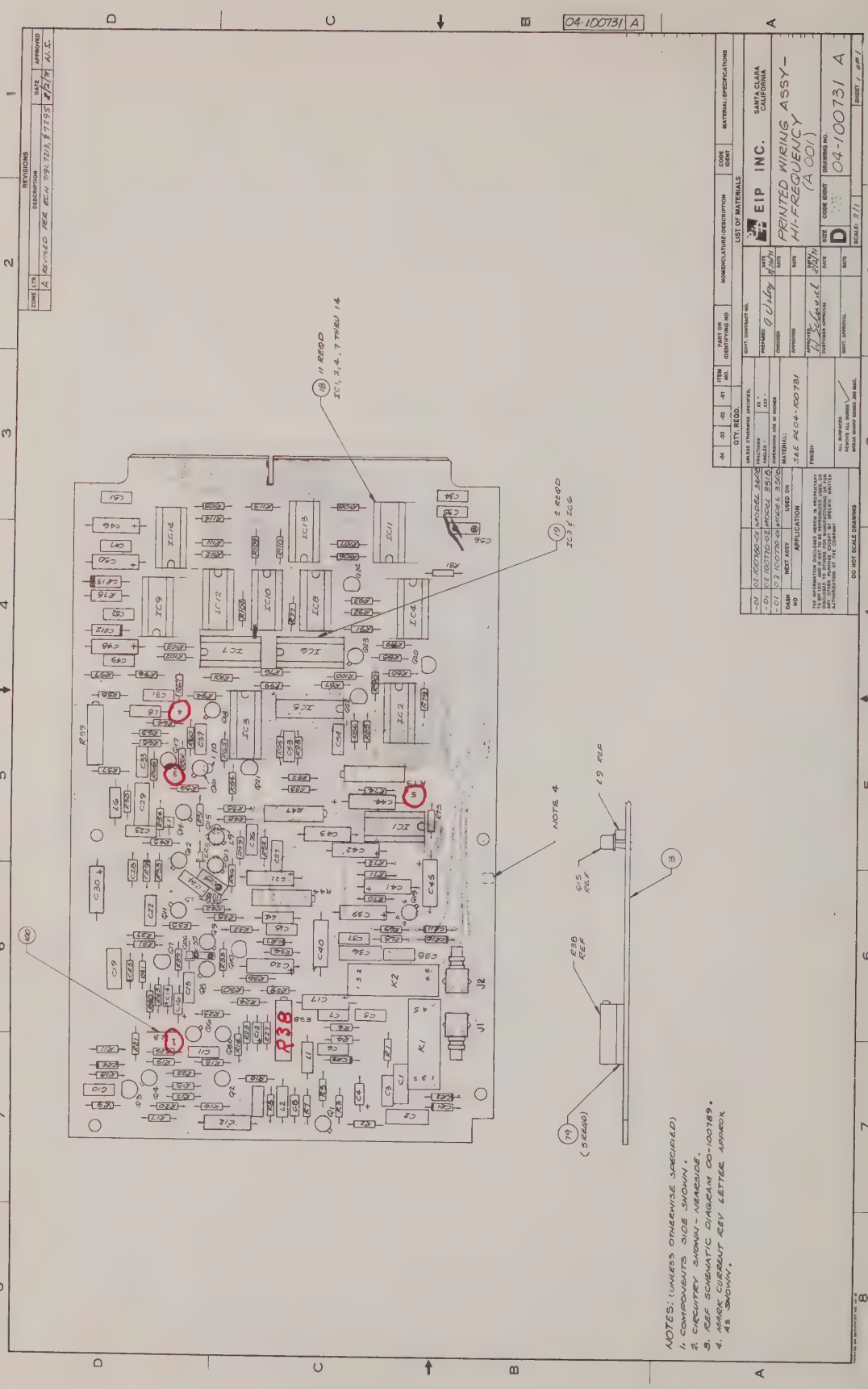

04-100731 A
EIP INC.
SANTA CLARA CALIFORNIA
PRINTED WIRING ASSY-HI-FREQUENCY (A 001)
04-100731 A
SIZE D
SCALE: 2/1
SHEET 1 OF 1
LIST OF MATERIALS
NOMENCLATURE/DESCRIPTION
MATERIAL SPECIFICATIONS
DO NOT SCALE DRAWING
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. COMPONENTS SIDE SHOWN.
2. CIRCUITRY SHOWN - NEARSIDE.
3. REF SCHEMATIC DIAGRAM 00-100789.
4. MARK CURRENT REV LETTER APPROX AS SHOWN.
18 REQD IC1, 3, 4, 7 THRU 14
19 2 REQD IC5 & IC6
NOTE 4
19 REF
6.5 REF
E38 REF
19 (5 REQD)
R38

FIGURE 9-6

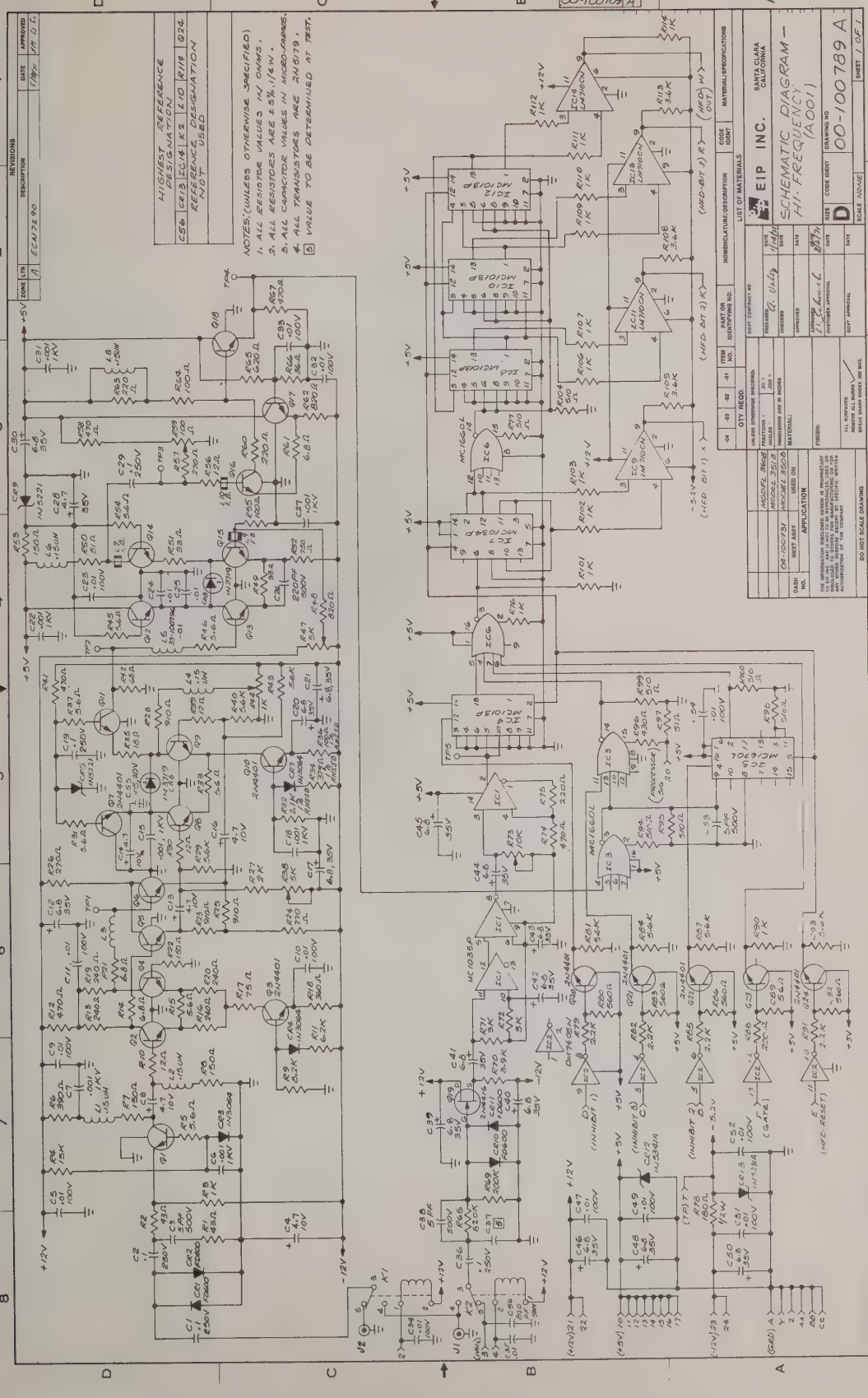

00-100789 A
EIP INC.
SANTA CLARA CALIFORNIA
SCHEMATIC DIAGRAM — HI-FREQUENCY (A001)
00-100789 A
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. ALL RESISTOR VALUES IN OHMS.
2. ALL RESISTORS ARE ± 5% 1/4 W.
3. ALL CAPACITOR VALUES IN MICRO-FARADS.
4. ALL TRANSISTORS ARE 2N5179.
5. VALUE TO BE DETERMINED AT TEST.
HIGHEST REFERENCE DESIGNATION
REFERENCE DESIGNATION NOT USED
MODEL 350B
MODEL 351B
DO NOT SCALE DRAWING

FIGURE 9-7

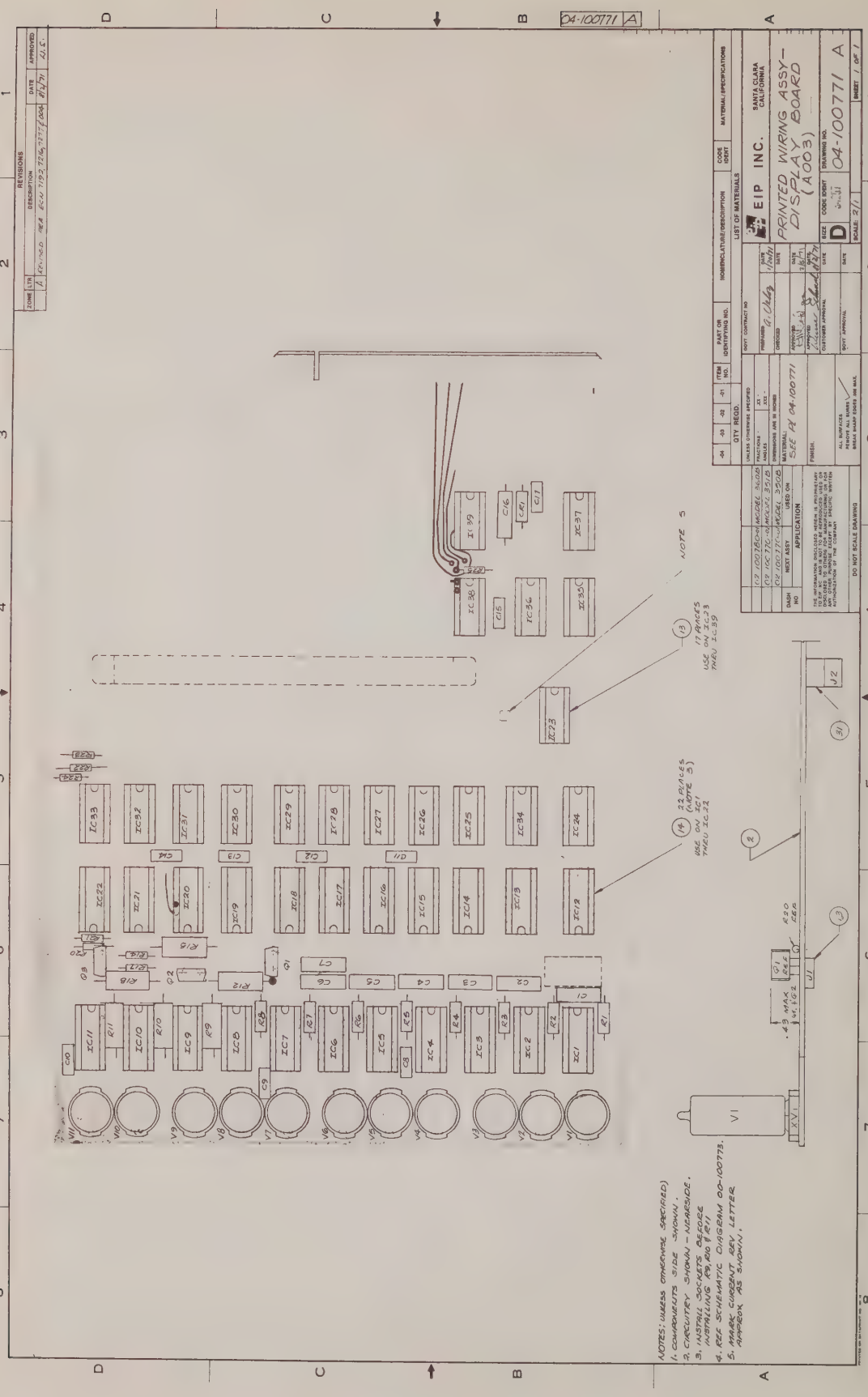

04-100771 A
EIP INC.
SANTA CLARA CALIFORNIA
PRINTED WIRING ASSY-DISPLAY BOARD (A003)
04-100771 A
NOTES: UNLESS OTHERWISE SPECIFIED)
1. COMPONENTS SIDE SHOWN.
2. CIRCUITRY SHOWN - NEARSIDE.
3. INSTALL SOCKETS BEFORE INSTALLING R9, R10 & R11
4. REF SCHEMATIC DIAGRAM 04-100773.
5. MARK CURRENT REV LETTER APPROX AS SHOWN.

FIGURE 9-8

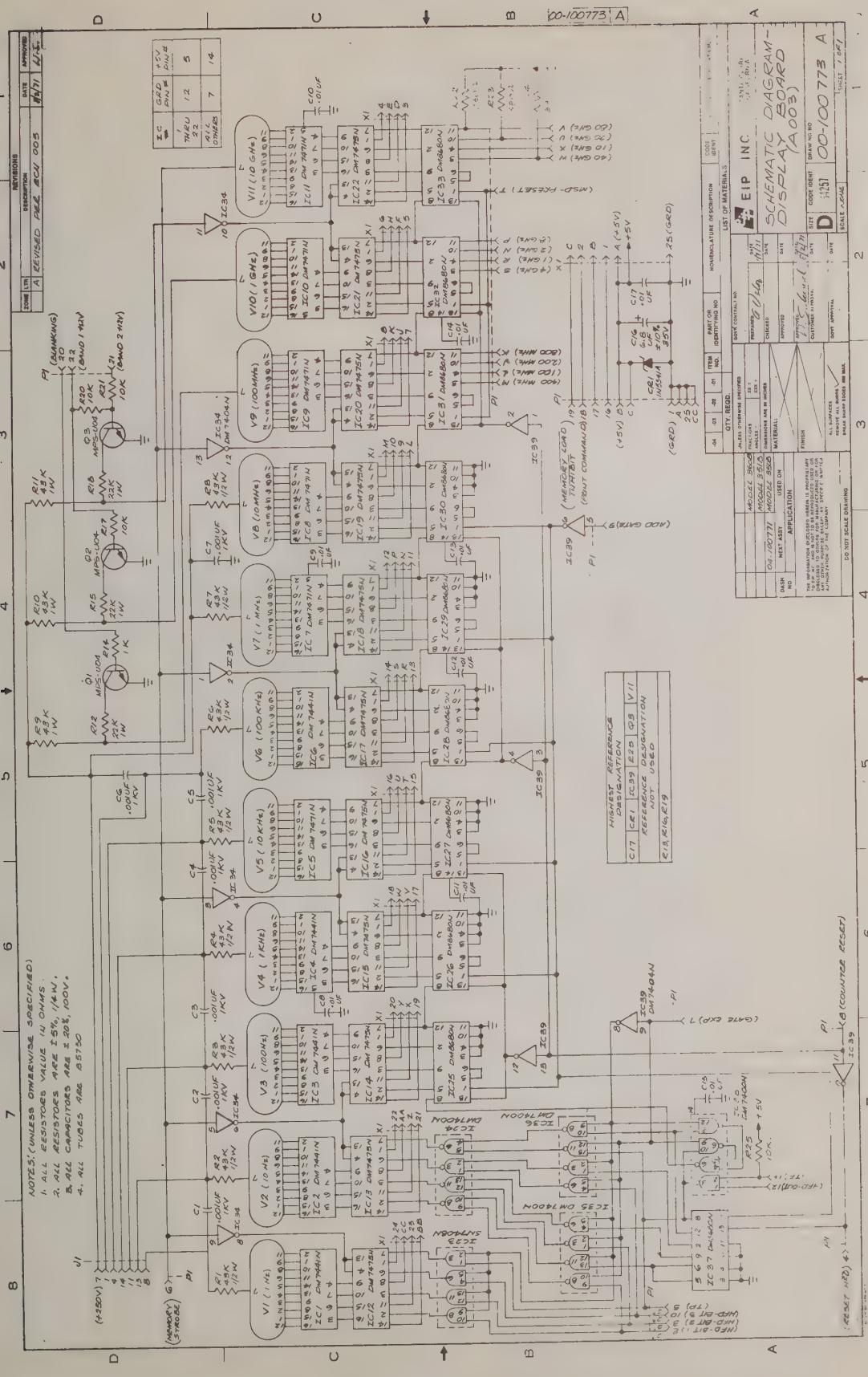

00-100773 A
EIP INC
SCHEMATIC DIAGRAM-DISPLAY BOARD (A003)
00-100773 A
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. ALL RESISTORS VALUE IN OHMS.
2. ALL RESISTORS ARE ±5%, 1/4W.
3. ALL CAPACITORS ARE ±20%, 100V.
4. ALL TUBES ARE 6570
HIGHEST REFERENCE DESIGNATION
C17 | C21 | IC39 | E23 | Q3 | V11
REFERENCE DESIGNATION NOT USED
E13, R16, R19

FIGURE 9-9

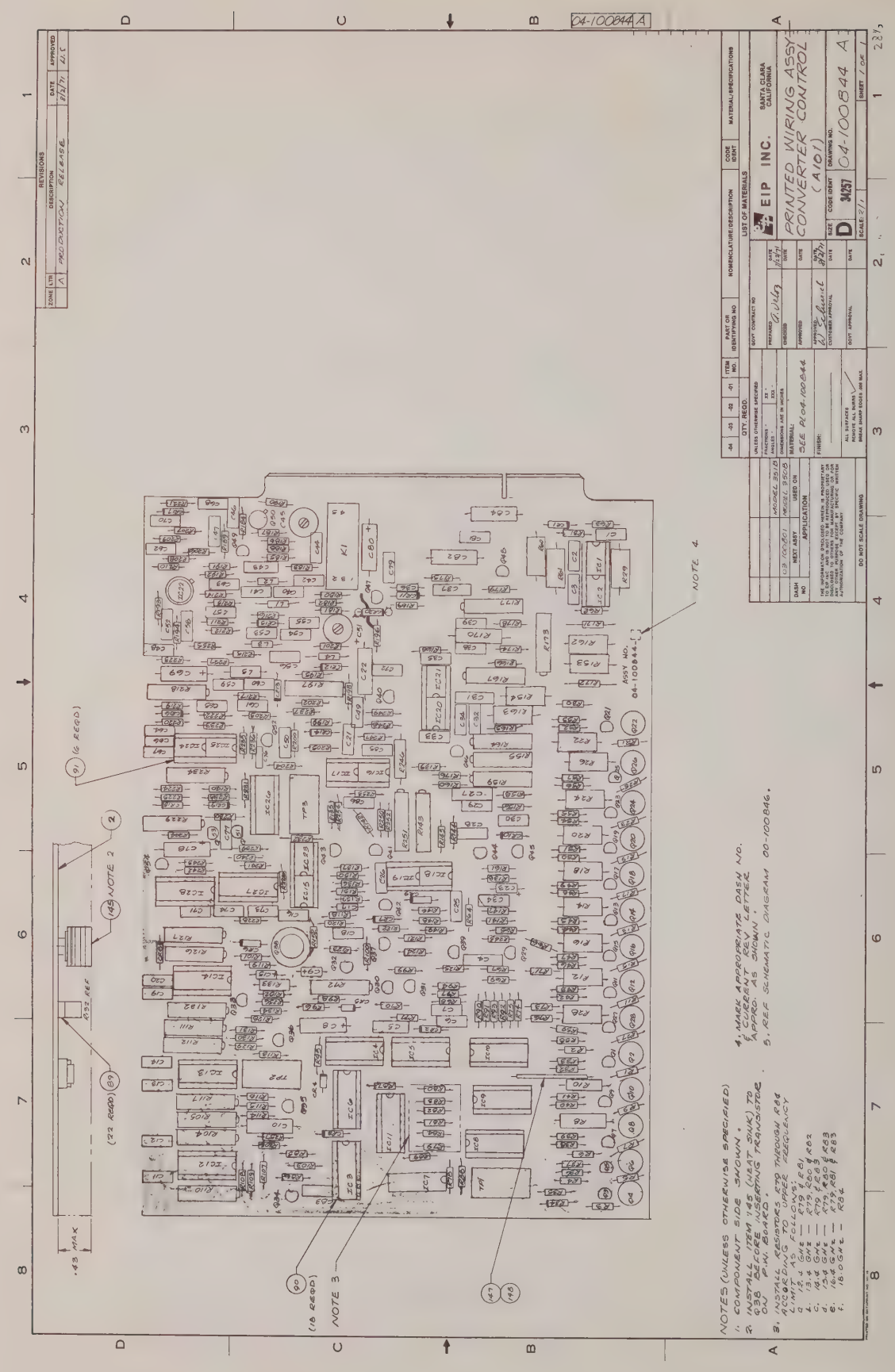

04-100844 A
EIP INC.
SANTA CLARA CALIFORNIA
PRINTED WIRING ASSY CONVERTER CONTROL (A101)
04-100844 A
SIZE D
SCALE 2/1
SHEET 1 OF 1
NOTES (UNLESS OTHERWISE SPECIFIED)
1. COMPONENT SIDE SHOWN.
2. INSTALL ITEM 145 (HEAT SINK) TO Q38 BEFORE INSERTING TRANSISTOR ON P.W. BOARD.
3. INSTALL RESISTORS R79 THROUGH R84 AS FOLLOWS:
FOR DASH NO. FREQUENCY
a. 12.4 GHz — R79 & R81
b. 13.4 GHz — R79, R80 & R82
c. 14.4 GHz — R79, R80 & R83
d. 15.4 GHz — R79, R81 & R83
e. 16.0 GHz — R84
f. 18.0 GHz — R84
4. MARK APPROPRIATE DASH NO. & CURRENT REV LETTER APPRO. AS SHOWN.
5. REF SCHEMATIC DIAGRAM 01-100 BAG.
NOTE 2
NOTE 3
NOTE 4
(6 REQD)
(22 REQD)
(18 REQD)
.43 MAX
.432 REF

FIGURE 9-10

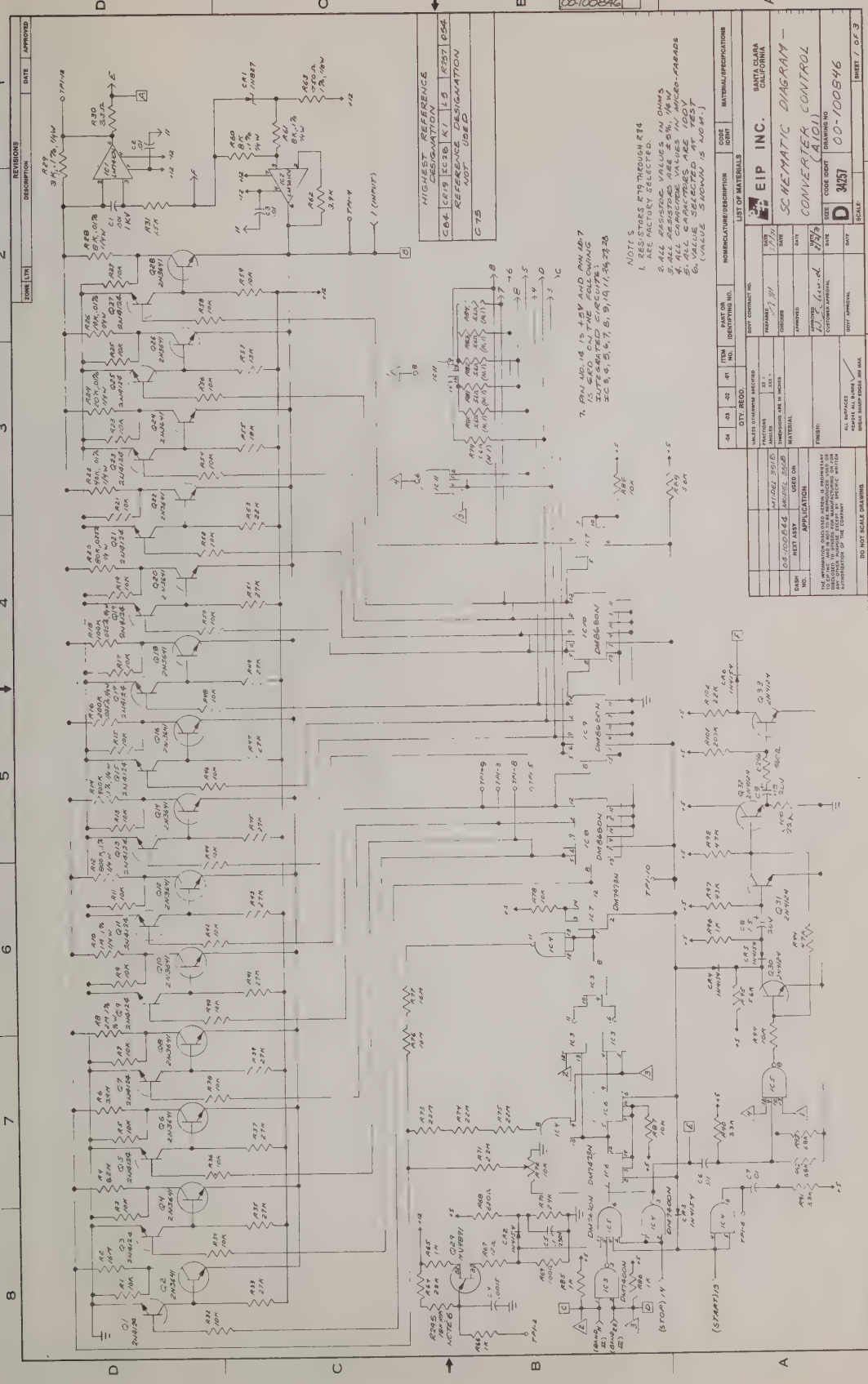

EIP INC.
SANTA CLARA CALIFORNIA
SCHEMATIC DIAGRAM — CONVERTER CONTROL (A101)
CODE IDENT 34257
DRAWING NO 00-100846
SIZE D
SHEET 1 OF 3
00-100846
NOTES
1. RES STORS R79 THROUGH R94 ARE FACTORY SELECTED.
2. ALL RESISTOR VALUES IN OHMS
3. ALL RESISTORS ARE ±5%, 1/8 W
4. ALL CAPACITORS ARE 100V MICRO-FARADS
5. ALL DIODES ARE 100V
6. VALUE SELECTED AT TEST (VALUE SHOWN IS NOM.)
7. PIN NO. 14 IS +5V AND PIN NO 7 IS GRD. ON THE FOLLOWING IC'S: 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 23, 25
HIGHEST REFERENCE DESIGNATION
C64 | IC26 | K1 | L5 | R257 | Q54
REFERENCE DESIGNATION NOT USED
G75
LIST OF MATERIALS
PART OR IDENTIFYING NO. | NOMENCLATURE/DESCRIPTION | CODE IDENT | MATERIAL/SPECIFICATIONS
QTY. REQD.
DASH NO. | NEXT ASSY | USED ON | APPLICATION
04-100844 | MODEL 3516 | MODEL 3568
UNLESS OTHERWISE SPECIFIED
FRACTIONS ±1/32
ANGLES ±1°
DIMENSIONS ARE IN INCHES
MATERIAL
FINISH:
DO NOT SCALE DRAWING
THE INFORMATION DISCLOSED HEREIN IS PROPRIETARY TO EIP INC. AND IS NOT TO BE REPRODUCED, USED OR DISCLOSED TO OTHERS WITHOUT THE SPECIFIC WRITTEN AUTHORIZATION OF THE COMPANY.
DRAWN
CHECKED
APPROVED
CUSTOMER APPROVAL
GOVT. APPROVAL
DATE
REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVED

FIGURE 9-11

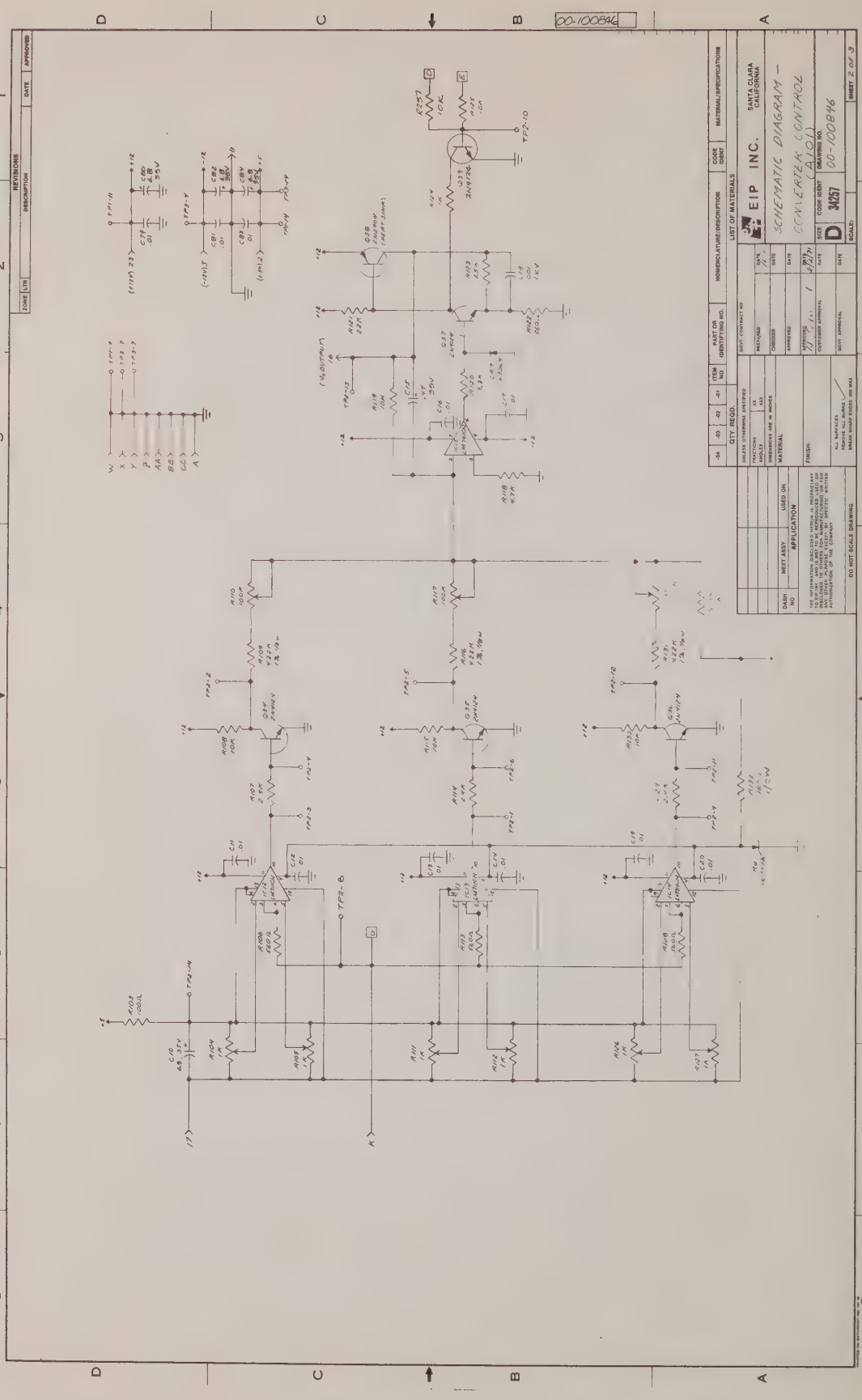
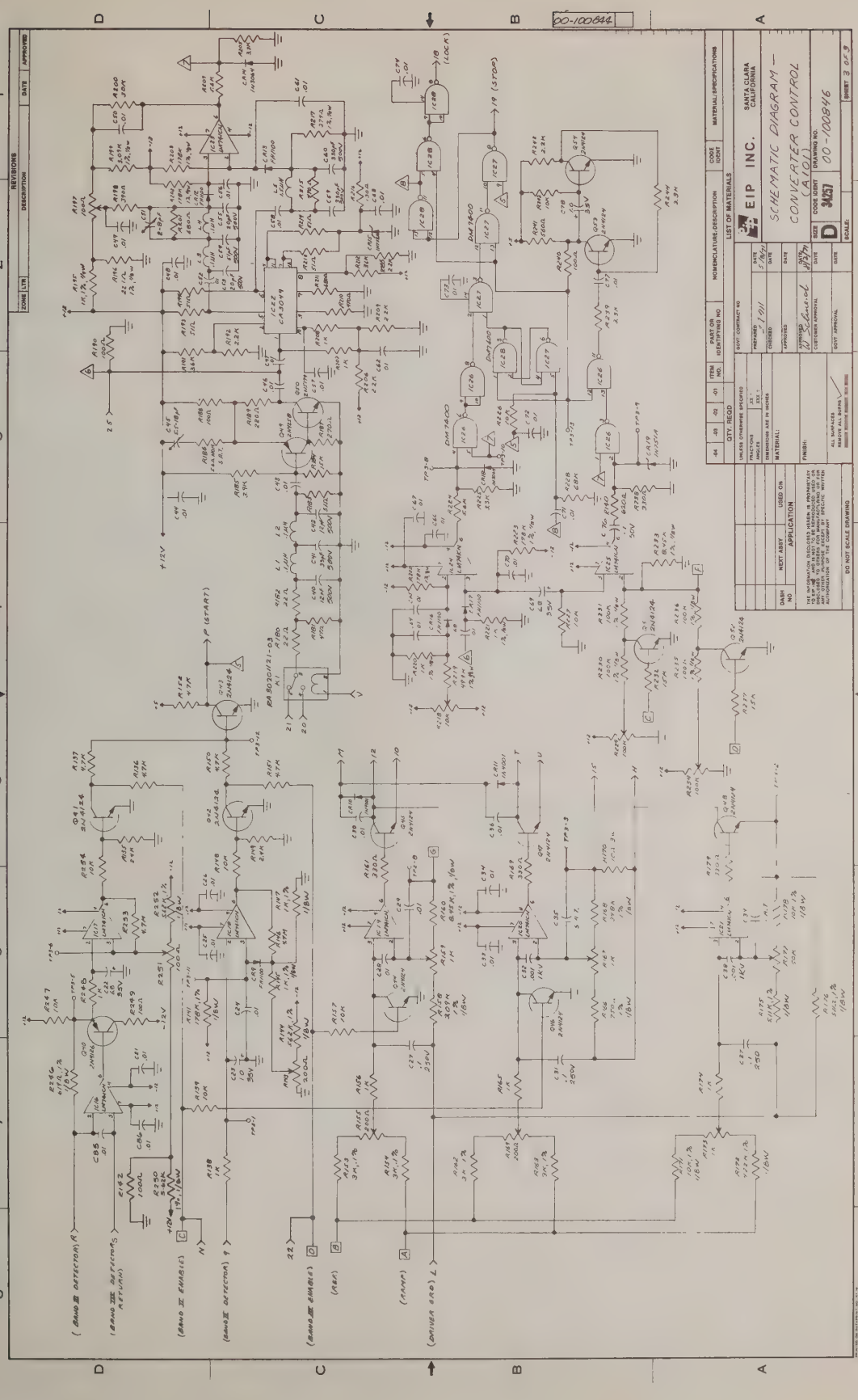
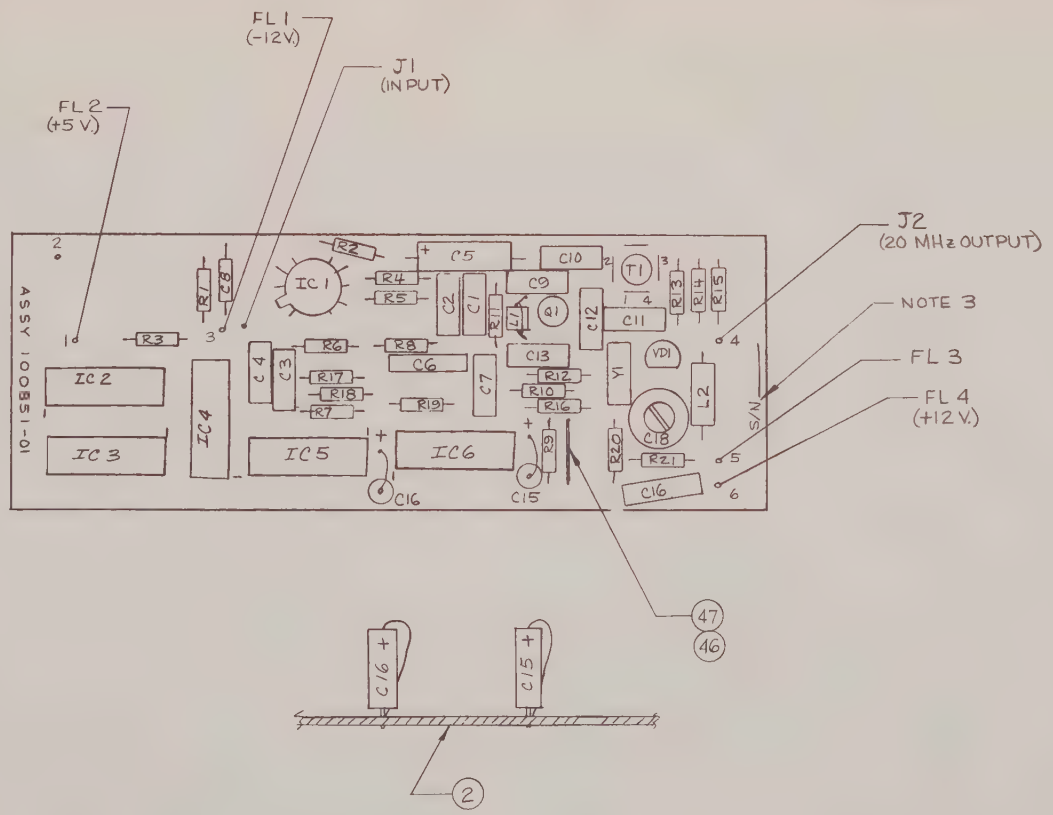


FIGURE 9-11 (Cont'd.)


EIP INC.
SANTA CLARA CALIFORNIA
SCHEMATIC DIAGRAM — CONVEYATER CONTROL
00-100846
00-100844
DO NOT SCALE DRAWING

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



NOTES:

1. CIRCUITRY SHOWN IS ON COMPONENT SIDE.
2. REF: SCHEMATIC DIAGRAM 00-100852.
3. MARK S/N APPROX. AS SHOWN.

-04	-03	-02	-01	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE/DESCRIPTION	CODE IDENT	MATERIAL/SPECIFICATIONS
QTY. REQD.				LIST OF MATERIALS				

		361/362/363
-01	04-100850	350B/351B
DASH NO.	NEXT ASSY	USED ON
APPLICATION		

THE INFORMATION DISCLOSED HEREIN IS PROPRIETARY TO EIP LABS AND IS NOT TO BE REPRODUCED, USED, OR DISCLOSED TO OTHERS FOR MANUFACTURING OR FOR ANY OTHER PURPOSE EXCEPT BY SPECIFIC WRITTEN AUTHORIZATION OF THE COMPANY.

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED:
FRACTIONS ± .XX ±
ANGLES ± .XXX ±
DIMENSIONS ARE IN INCHES
MATERIAL: SEE PL 04-100851
FINISH:
ALL SURFACES REMOVE ALL BURRS BREAK SHARP EDGES .005 MAX.

GOVT. CONTRACT NO.

		DATE
PREPARED	R. Wise	1/5/71
CHECKED		DATE
APPROVED	R. Cooper	DATE
APPROVED		DATE
CUSTOMER APPROVAL	W. Schmidt	2/24/71
GOVT. APPROVAL		DATE

EIP LABS SANTA CLARA CALIFORNIA

PRINTED WIRING ASSY
PHASE-LOCK OSCILLATOR
(ASSY 132A1)

SIZE	CODE IDENT	DRAWING NO.
C	34371	04-100851

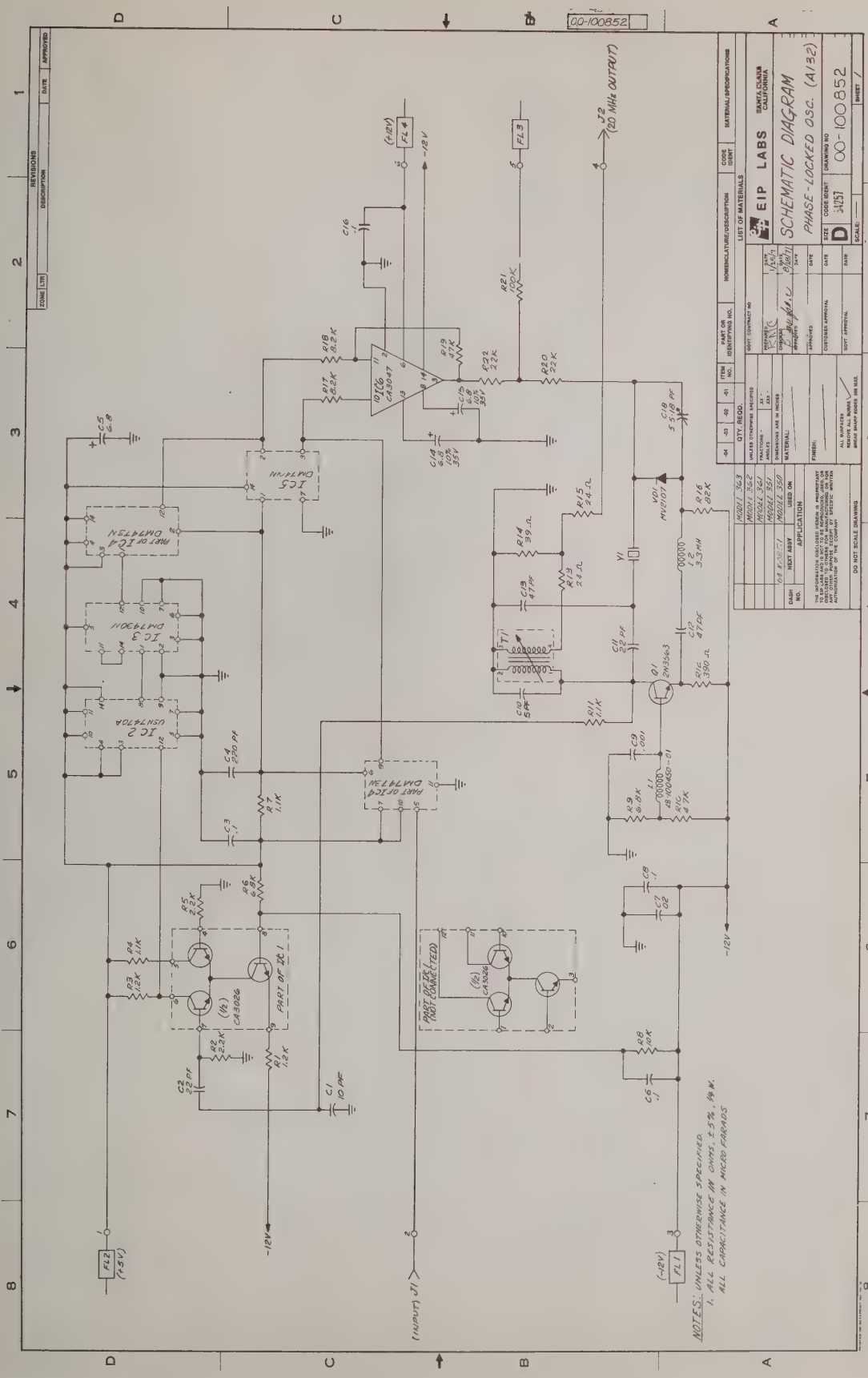
SCALE: 2/1 SHEET

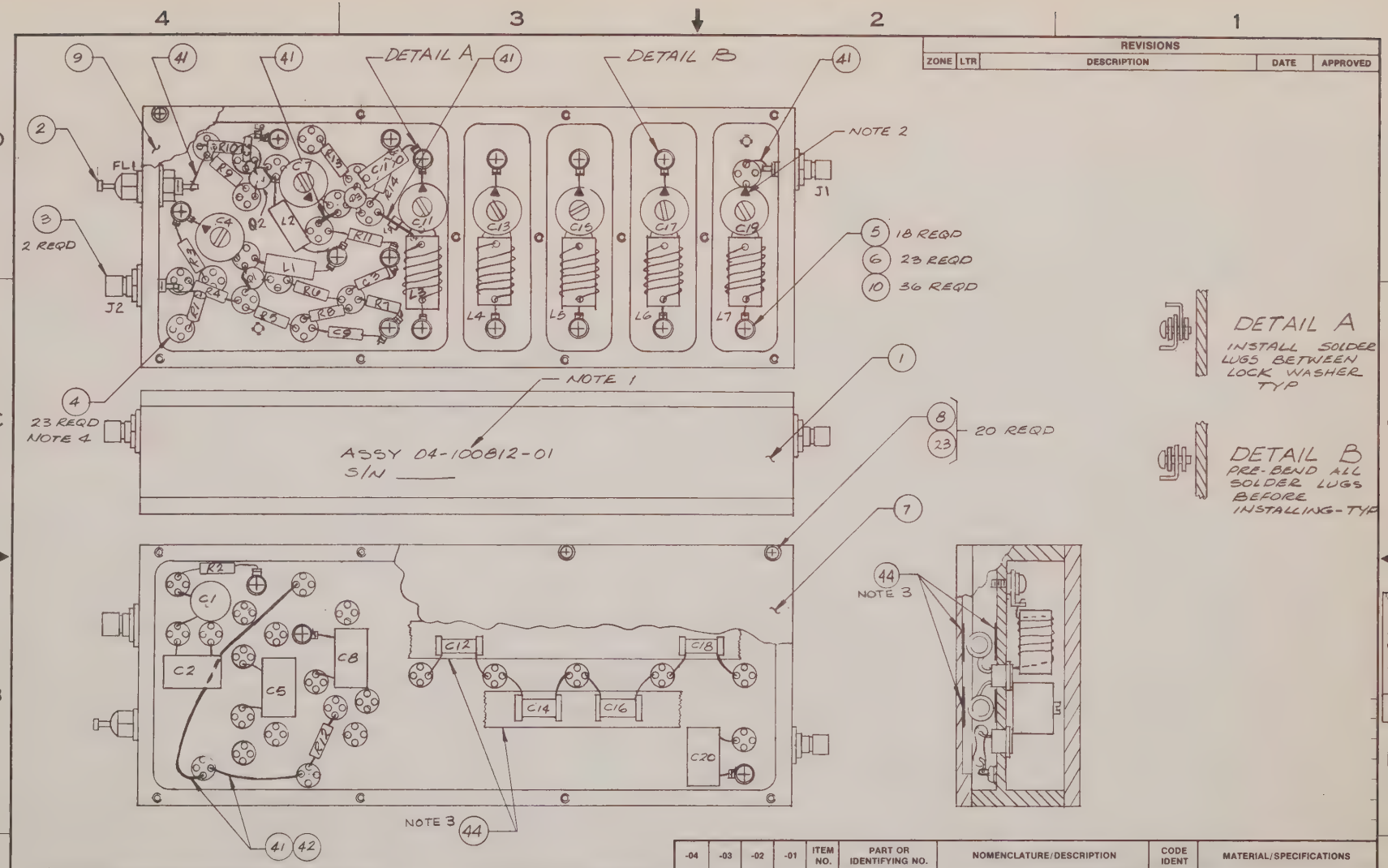
04-100851

FIGURE 9-12

350B/351B

PRINTED ON DATAPRINT NO 101-10


00-100852
EIP LABS
SCHEMATIC DIAGRAM
PHASE-LOCKED osc. (A132)
00-100852
(+12V)
-12V
(-12V)
(+15V)
(INPUT) J1
J2 (20 MHz OUTPUT)
FL1
FL2
FL3
FL4
IC1 CM74C74N
IC2 USN7404A
IC3 CM7490N
PART OF IC4 CM7473N
PART OF IC1
PART OF IC4 CM7473N
PART OF IC4 CM7473N
PART OF IC4 NOT CONNECTED
(1/2) CA3026
(1/2) CA3026
10116 CA3047
Q1 2N3563
VD1 MV2107
T1
L1 #8 100450-01
R1 390Ω
R2 2.2K
R3 1.2K
R4 1.1K
R5 2.2K
R6 6.8K
R7 1.1K
R8 6.8K
R9 6.8K
R10 1.1K
R11 1.1K
R12 10K
R13 24Ω
R14 39Ω
R15 24Ω
R16 82K
R17 8.2K
R18 8.2K
R19 47K
R20 22K
R21 100K
R22 22K
C1 10 PF
C2 22 PF
C3 .1
C4 220 PF
C5 6.8
C6 .1
C7 .1
C8 .1
C9 .001
C10 5PF
C11 47 PF
C12 47 PF
C13 47 PF
C14 6.8 10% 35V
C15 6.8 10% 35V
C16 .1
C17 3.5 MH
C18 5-18 PF
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTANCE IN OHMS, ±5%, ¼ W.
ALL CAPACITANCE IN MICRO FARADS



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

NOTES: (UNLESS OTHERWISE SPECIFIED:
1. MARK ASSY, PART NO., CURRENT REV LETTER & S/N APPROX AS SHOWN.
2. ▲ INDICATES CAPACITOR ROTOR. CAPACITOR TO BE MOUNTED AS SHOWN.
3. APPLY INSULATING ADHESIVE TAPE APPROX. AS SHOWN.
4. INSTALL TEFLON TERMINALS FROM THIS SIDE OF CHASSIS AS SHOWN.

DASH NO.	NEXT ASSY	USED ON
	04-100515	MODEL 363A
	04-100515	MODEL 362A
	04-100515	MODEL 361A
	02-100801	MODEL 351B
	02-100800	MODEL 350B

APPLICATION

THE INFORMATION DISCLOSED HEREIN IS PROPRIETARY TO EIP LABS AND IS NOT TO BE REPRODUCED, USED, OR DISCLOSED TO OTHERS FOR MANUFACTURING OR FOR ANY OTHER PURPOSE EXCEPT BY SPECIFIC WRITTEN AUTHORIZATION OF THE COMPANY.

DO NOT SCALE DRAWING

-04	-03	-02	-01	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE/DESCRIPTION	CODE IDENT	MATERIAL/SPECIFICATIONS
QTY. REQD.						LIST OF MATERIALS		

UNLESS OTHERWISE SPECIFIED:
FRACTIONS .XX ±
ANGLES ± .XXX ±
DIMENSIONS ARE IN INCHES
MATERIAL: SEE 04-100812
FINISH:
ALL SURFACES REMOVE ALL BURRS ✓ BREAK SHARP EDGES .005 MAX.

GOVT. CONTRACT NO.

		DATE
PREPARED	A. Velay	11/3/70
CHECKED		
APPROVED	R.W. Sodaro	12/9/70
APPROVED		12/-/70
CUSTOMER APPROVAL	W. Schmeckebier	12/21/70
GOVT. APPROVAL		

EIP LABS SANTA CLARA CALIFORNIA

MODULE ASSY- X5 MULTIPLIER/FILTER

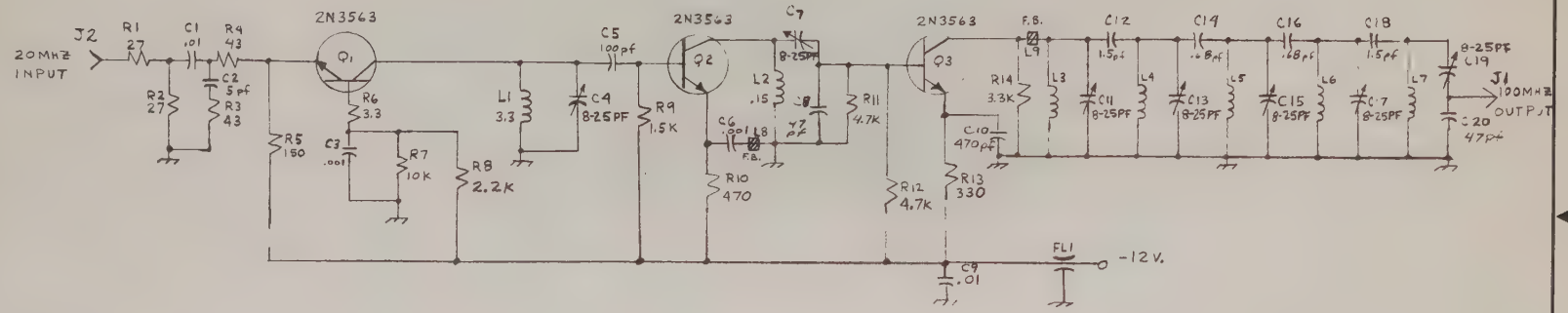
SIZE	CODE IDENT	DRAWING NO.
C		04-100812

SCALE: 2/1 SHEET 1 OF 1

PRINTED ON DATAPRINT NO 101-10

04-100812

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



NOTES:

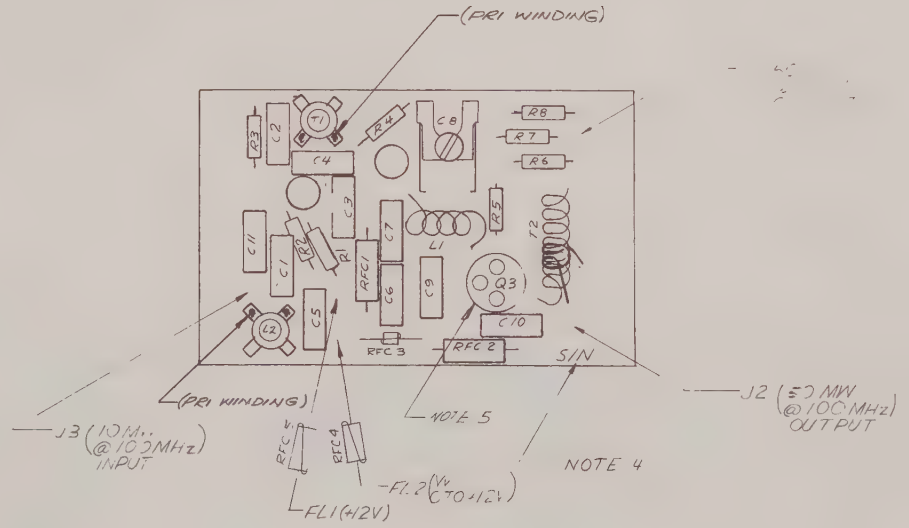
1. ALL CAPACITORS IN MFD. UNLESS OTHERWISE INDICATED.
2. ALL RESISTORS IN OHMS, ±5%, 1/4W.
3. L3,4,5,6,7 ARE EIP 28-100811-01
4. "F.B" INDICATES FERRITE BEAD

		UNLESS OTHERWISE NOTED: DIMENSIONS ARE IN INCHES	GOVT. CONTRACT NO.		EIP LABS SANTA CLARA CALIFORNIA
		TOLERANCES: .XX ± FRACTIONS ± .XXX ± ANGLES ±	PREPARED L. Hy	DATE 1/28/72	SCHEMATIC
		MATERIAL:	CHECKED	DATE	X5 MULTIPLIER-FILTER
			APPROVED	DATE 12/18/72	SIZE B / CODE IDENT 34257 / DRAWING NO. 00-100813
04-100812		FINISH:	APPROVED W. Schenck	DATE 12/21/72	
NEXT ASSY	USED ON		APPROVED	DATE	SCALE: / SHEET
APPLICATION					

THE INFORMATION DISCLOSED HEREIN IS PROPRIETARY TO EIP LABS AND IS NOT TO BE REPRODUCED, USED, OR DISCLOSED TO OTHERS FOR MANUFACTURING OR FOR ANY OTHER PURPOSE EXCEPT BY SPECIFIC WRITTEN AUTHORIZATION OF THE COMPANY.

FIGURE 9-15

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		[illegible]		
	B	SEE SCH 100374		



NOTES:
1. COMPONENTS SIDE SHOWN.
2. CIRCUITRY SHOWN — COMPONENTS SIDE.
3. REF. SCHEMATIC DIAGRAM 100374.
4. MARK S/N APPROX. AS SHOWN.
5. MOUNT Q3 FLUSH ON BOARD.

-04	-03	-02	-01	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE/DESCRIPTION	CODE IDENT	MATERIAL/SPECIFICATIONS
			QTY. REQD.		LIST OF MATERIALS			
			MODEL 363A					
			MODEL 362A					
			MODEL 361A					
			MODEL 351A					
		-01	100411					

DASH NO.	NEXT ASSY	USED ON
	APPLICATION	

THE INFORMATION DISCLOSED HEREIN IS PROPRIETARY TO EIP LABS AND IS NOT TO BE REPRODUCED, USED, OR DISCLOSED TO OTHERS FOR MANUFACTURING OR FOR ANY OTHER PURPOSE EXCEPT BY SPECIFIC WRITTEN AUTHORIZATION OF THE COMPANY.

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED:
FRACTIONS ± .01 ANGLES ± .005 .XX ± .XXX ±
DIMENSIONS ARE IN INCHES
MATERIAL: SEE PL100372
FINISH:
ALL SURFACES REMOVE ALL BURRS BREAK SHARP EDGES .005 MAX.

GOVT. CONTRACT NO.		
PREPARED	G.C. APPLEBY	9/3/69
CHECKED	G. Velez	9/11/69
APPROVED	[illegible]	
APPROVED	[illegible]	11/23/69
CUSTOMER APPROVAL		
GOVT. APPROVAL		

EIP LABS SANTA CLARA CALIFORNIA

PRINTED WIRING ASSY - DUAL POWER AMP ASSY 106AI

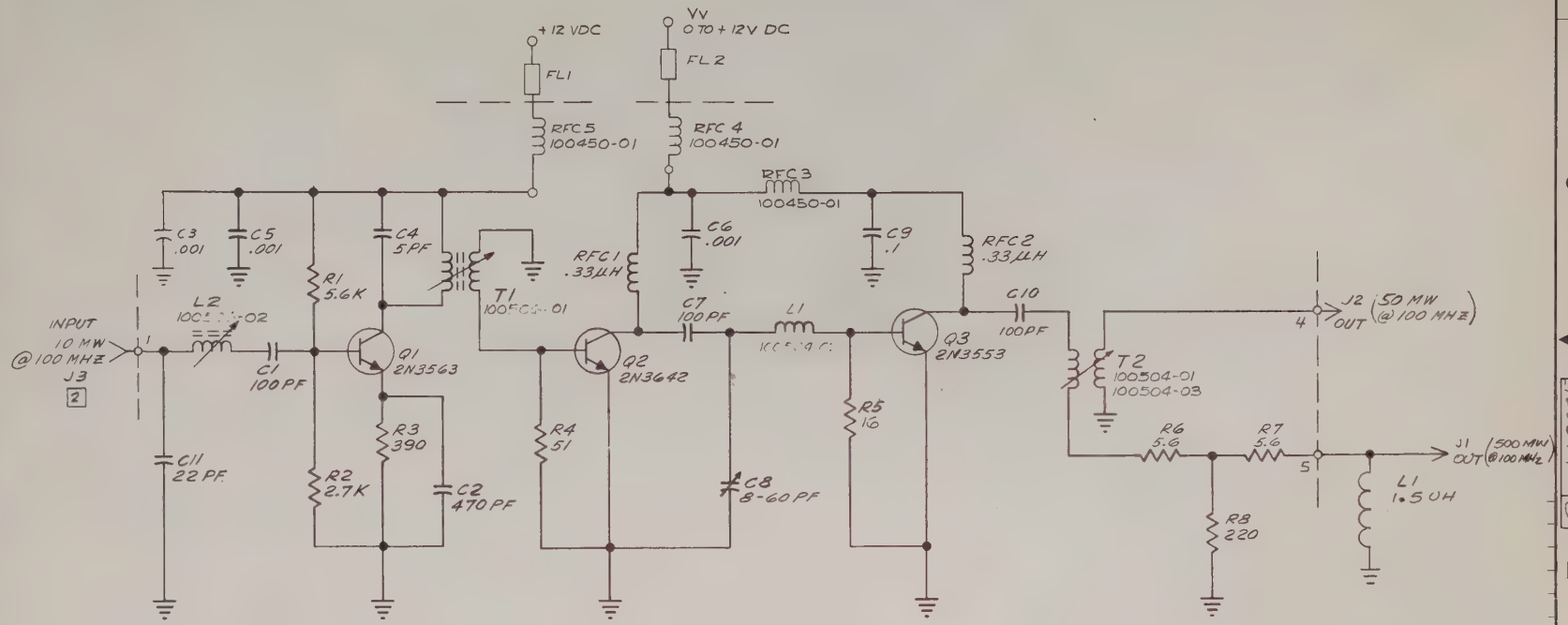
SIZE	CODE IDENT	DRAWING NO.
C		100372 B

SCALE: 2/1 SHEET 1 OF 1

PRINTED ON DATAPRINT NO 101-10

100372 B

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REVISED PER ECN 1232		
	B	REVISED PER ECN 1264		
	C	ADDED 1.5 INDUCTOR PER ECN 7088	3/27/	



NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTANCE IN OHMS, ±5%, ¼W
ALL CAPACITANCE IN MICRO FARADS

[2] COMPONENTS OUTSIDE DOTTED LINE MOUNTED ON ASSY 100411

-04	-03	-02	-01	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE/DESCRIPTION	CODE IDENT	MATERIAL/SPECIFICATIONS
QTY. REQD.					LIST OF MATERIALS			

DASH NO.	NEXT ASSY	USED ON
		MODEL 363A
		MODEL 362A
		MODEL 351A
	100372	MODEL 350A
APPLICATION		

THE INFORMATION DISCLOSED HEREIN IS PROPRIETARY TO EIP LABS AND IS NOT TO BE REPRODUCED, USED, OR DISCLOSED TO OTHERS FOR MANUFACTURING OR FOR ANY OTHER PURPOSE EXCEPT BY SPECIFIC WRITTEN AUTHORIZATION OF THE COMPANY.

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED:
FRACTIONS ± .XX ±
ANGLES ± .XXX ±
DIMENSIONS ARE IN INCHES
MATERIAL:
FINISH:
ALL SURFACES REMOVE ALL BURRS BREAK SHARP EDGES .005 MAX.

GOVT. CONTRACT NO.

		DATE
PREPARED	M.J. KOOREN	8/18/69
CHECKED		9/2/69
APPROVED		9/11/69
APPROVED		10/29/69
CUSTOMER APPROVAL		DATE
GOVT. APPROVAL		DATE

EIP LABS SANTA CLARA CALIFORNIA

SCHEMATIC, DIAGRAM
DUAL POWER AMPLIFIER (A106)

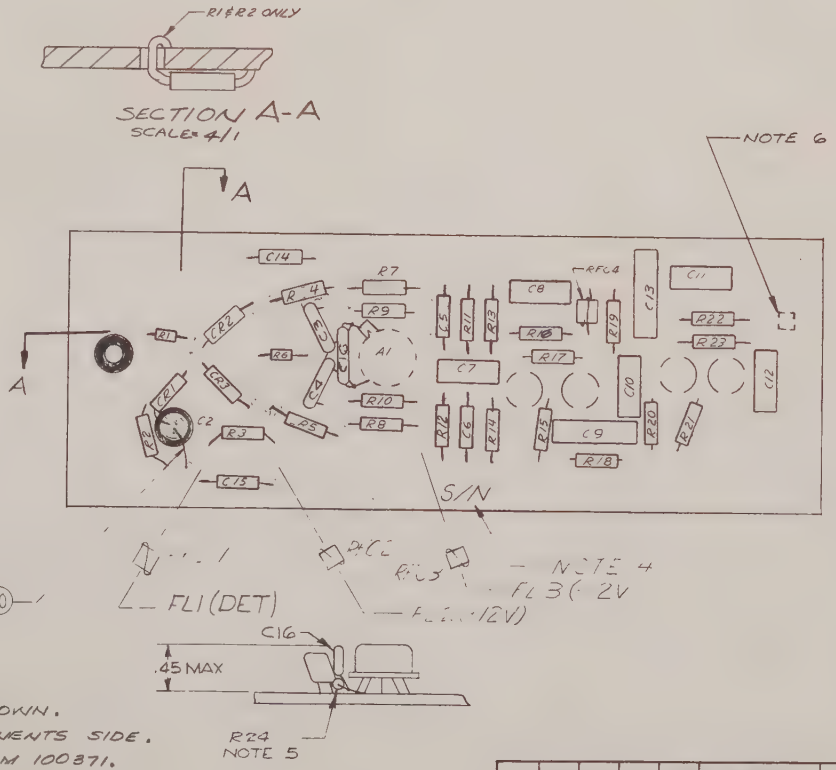
SIZE	CODE IDENT	DRAWING NO.
C		100374 C

SCALE: —— SHEET 1 OF 1

100374 C

PRINTED ON DATAPRINT NO 101-10

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REVISED PER ECN 1216	7/-	
	B	REVISED PER ECN 1257 & 1278 & 1	4/-	
	C	PL CHANGE ONLY PER ECN 7093	1/11/7-	



NOTES.
1. COMPONENTS SIDE SHOWN.
2. CIRCUITRY SHOW-COMPONENTS SIDE.
3. REF SCHEMATIC DIAGRAM 100371.
4. MARK S/N APPROX AS SHOWN.
5. SOLDER C16 TO R24 APPROX AS SHOWN AND SOLDER R24 LEADS TO COPPER PAD ON BD.
6. MARK APPROPRIATE REV LETTER APPROX AS SHOWN.

-04	-03	-02	-01	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE/DESCRIPTION	CODE IDENT	MATERIAL/SPECIFICATIONS
QTY. REQD.					LIST OF MATERIALS			

		MFR. -61A
		MODEL 351A
-01	100416	NOTE - SEE A
DASH NO.	NEXT ASSY	USED ON
	APPLICATION	

THE INFORMATION DISCLOSED HEREIN IS PROPRIETARY TO EIP LABS AND IS NOT TO BE REPRODUCED, USED, OR DISCLOSED TO OTHERS FOR MANUFACTURING OR FOR ANY OTHER PURPOSE EXCEPT BY SPECIFIC WRITTEN AUTHORIZATION OF THE COMPANY

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED:
FRACTIONS .XX :
ANGLES .XXX :
DIMENSIONS ARE IN INCHES
MATERIAL: SEE PL 100369
FINISH:
ALL SURFACES REMOVE ALL BURRS BREAK SHARP EDGES .005 MAX

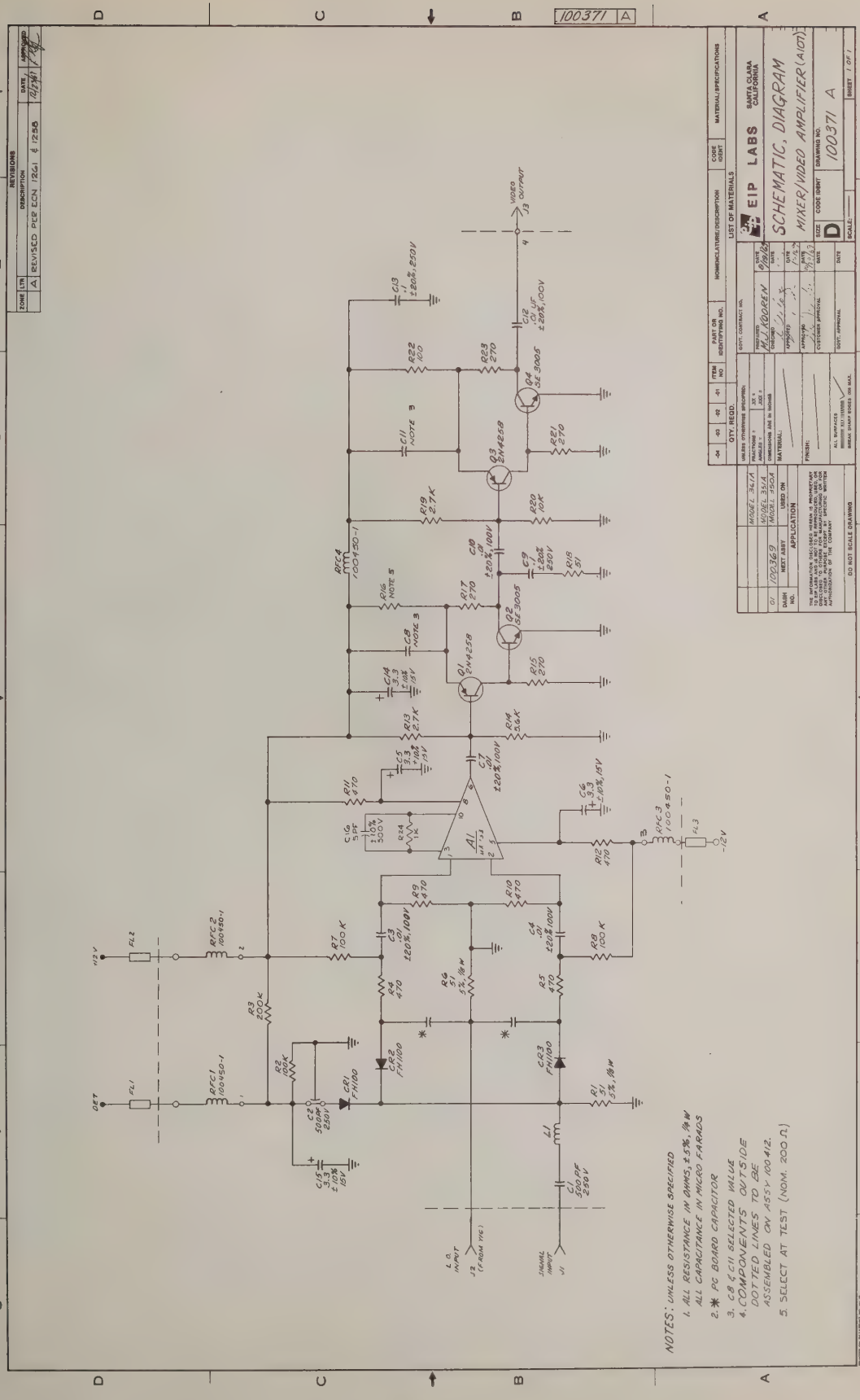
GOVT. CONTRACT NO.
PREPARED — DATE
CHECKED — DATE 3/12/79
APPROVED — DATE
APPROVED — DATE
CUSTOMER APPROVAL — DATE
GOVT. APPROVAL — DATE

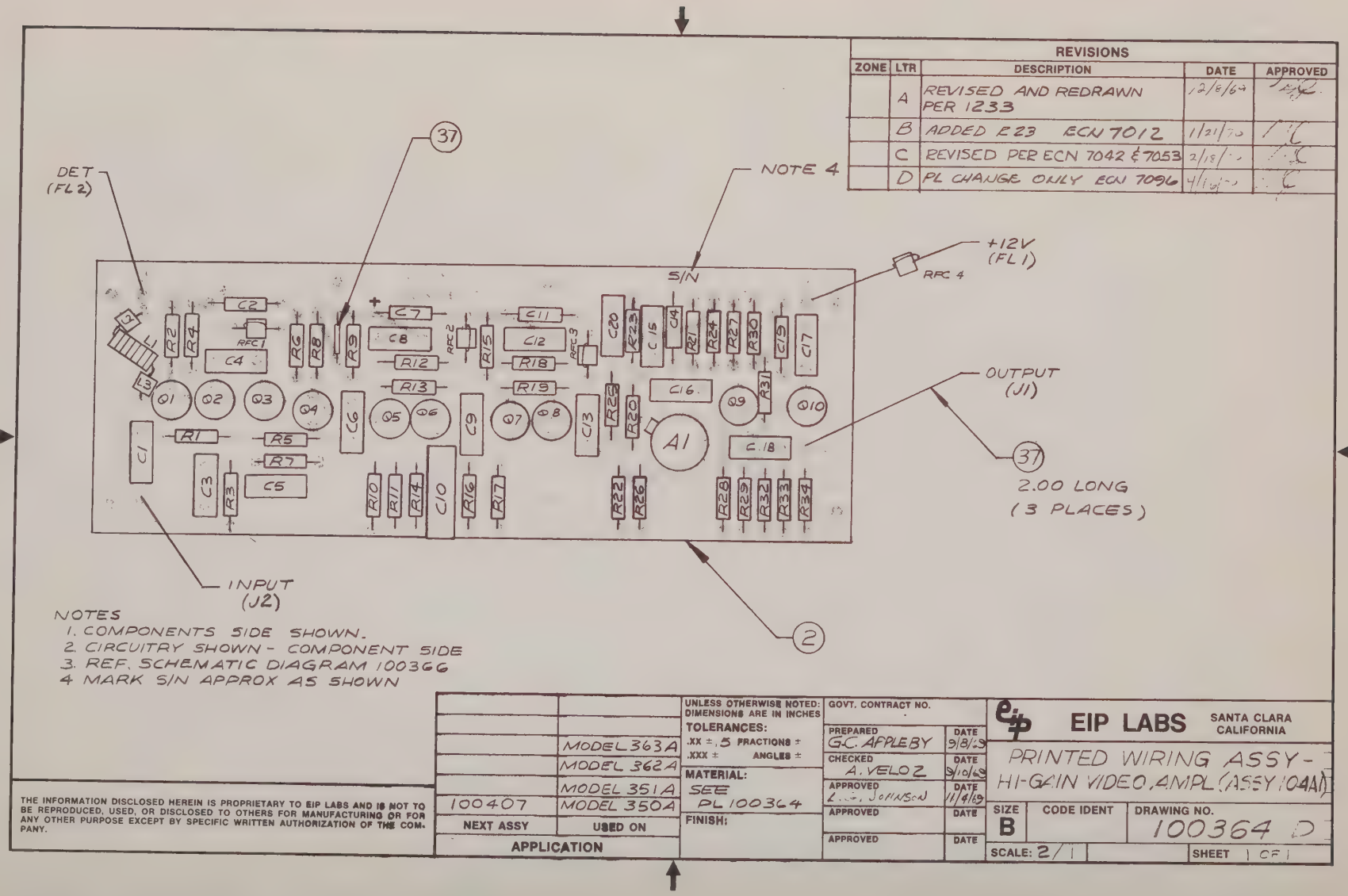
EIP LABS SANTA CLARA CALIFORNIA

SIZE C | CODE IDENT | DRAWING NO.

SCALE: 2/1 | SHEET

PRINTED ON DATAPRINT NO 101-10


100371 A
REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
A REVISED PER ECN 1261 & 1250 10/30/67
EIP LABS SANTA CLARA CALIFORNIA
SCHEMATIC, DIAGRAM
MIXER/VIDEO AMPLIFIER (A10T)
SIZE D CODE IDENT DRAWING NO. 100371 A
SCALE: — SHEET 1 OF 1
DO NOT SCALE DRAWING
LIST OF MATERIALS
ITEM NO. PART OR IDENTIFYING NO. NOMENCLATURE/DESCRIPTION CODE IDENT MATERIAL/SPECIFICATIONS
QTY. REQD.
UNLESS OTHERWISE SPECIFIED
MODEL 341A
MODEL 350A
MODEL 350B
NEXT ASSY
USED ON
APPLICATION
MATERIAL
FINISH:
PREVIOUS CONTRACT NO.
PREPARED
CHECKED
APPROVED
CUSTOMER APPROVAL
GOVT. APPROVAL
DATE
THE INFORMATION DISCLOSED HEREIN IS PROPRIETARY TO EIP LABS AND IS NOT TO BE REPRODUCED OR DISCLOSED TO OTHERS FOR MANUFACTURING OR FOR ANY OTHER PURPOSE WITHOUT THE SPECIFIC WRITTEN AUTHORIZATION OF THE COMPANY
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTANCE IN OHMS, ±5%, ½W
ALL CAPACITANCE IN MICRO FARADS
2. * PC BOARD CAPACITOR
3. C8 & C11 SELECTED VALUE
4. COMPONENTS OUTSIDE DOTTED LINES TO BE ASSEMBLED ON ASSY 100412.
5. SELECT AT TEST (NOM. 200Ω)
+12V
-12V
OUTPUT
LO INPUT
SIGNAL INPUT
A1 μA733
Q1 2N4258
Q2 SE3005
Q3 2N4258
Q4 SE3005
CR1 FH100
CR2 FH100
CR3 FH100
L1 500 μH
RFC1 100450-1
RFC2 100450-1
RFC3 100450-1
RFC4 100450-1



NOTES
1. COMPONENTS SIDE SHOWN.
2. CIRCUITRY SHOWN - COMPONENT SIDE
3. REF. SCHEMATIC DIAGRAM 100366
4 MARK S/N APPROX AS SHOWN

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REVISED AND REDRAWN PER 1233	12/8/69	
	B	ADDED E23 ECN 7012	11/21/70	
	C	REVISED PER ECN 7042 & 7053	2/15/71	
	D	PL CHANGE ONLY ECN 7096	4/16/71	

	MODEL 363A
	MODEL 362A
	MODEL 351A
100407	MODEL 350A
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE NOTED: DIMENSIONS ARE IN INCHES
TOLERANCES: .XX ±.5 FRACTIONS ± .XXX ± ANGLES ±
MATERIAL: SEE PL 100364
FINISH:

GOVT. CONTRACT NO.

		DATE
PREPARED	G.C. APPLEBY	9/8/69
CHECKED	A. VELOZ	9/10/69
APPROVED	L. E. JOHNSON	11/4/69
APPROVED		DATE
APPROVED		DATE

EIP LABS SANTA CLARA CALIFORNIA

PRINTED WIRING ASSY - HI-GAIN VIDEO AMPL (ASSY 104A1)

SIZE	CODE IDENT	DRAWING NO.
B		100364 D

SCALE: 2/1 SHEET 1 OF 1

THE INFORMATION DISCLOSED HEREIN IS PROPRIETARY TO EIP LABS AND IS NOT TO BE REPRODUCED, USED, OR DISCLOSED TO OTHERS FOR MANUFACTURING OR FOR ANY OTHER PURPOSE EXCEPT BY SPECIFIC WRITTEN AUTHORIZATION OF THE COMPANY.

FIGURE 9-20

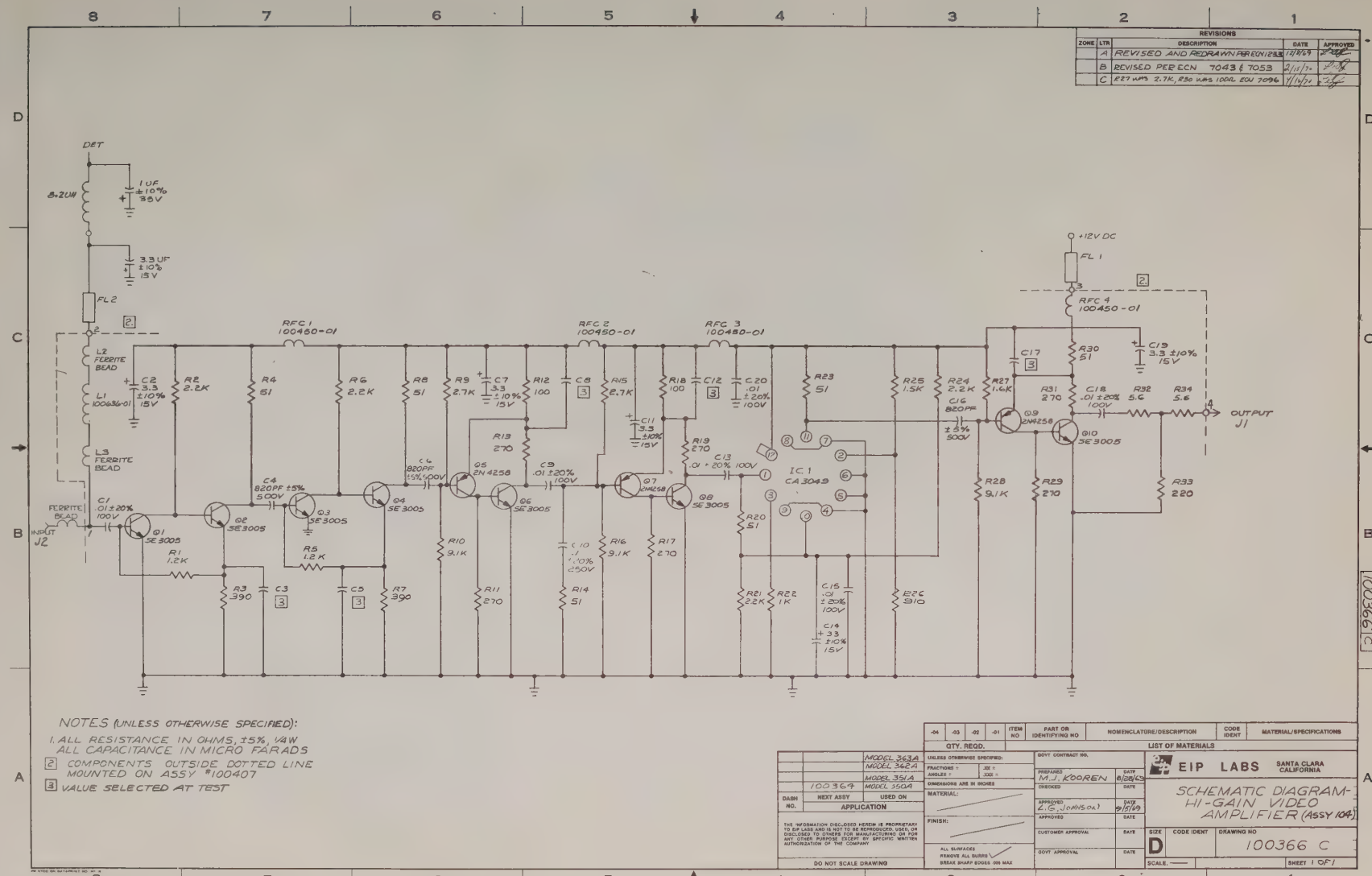
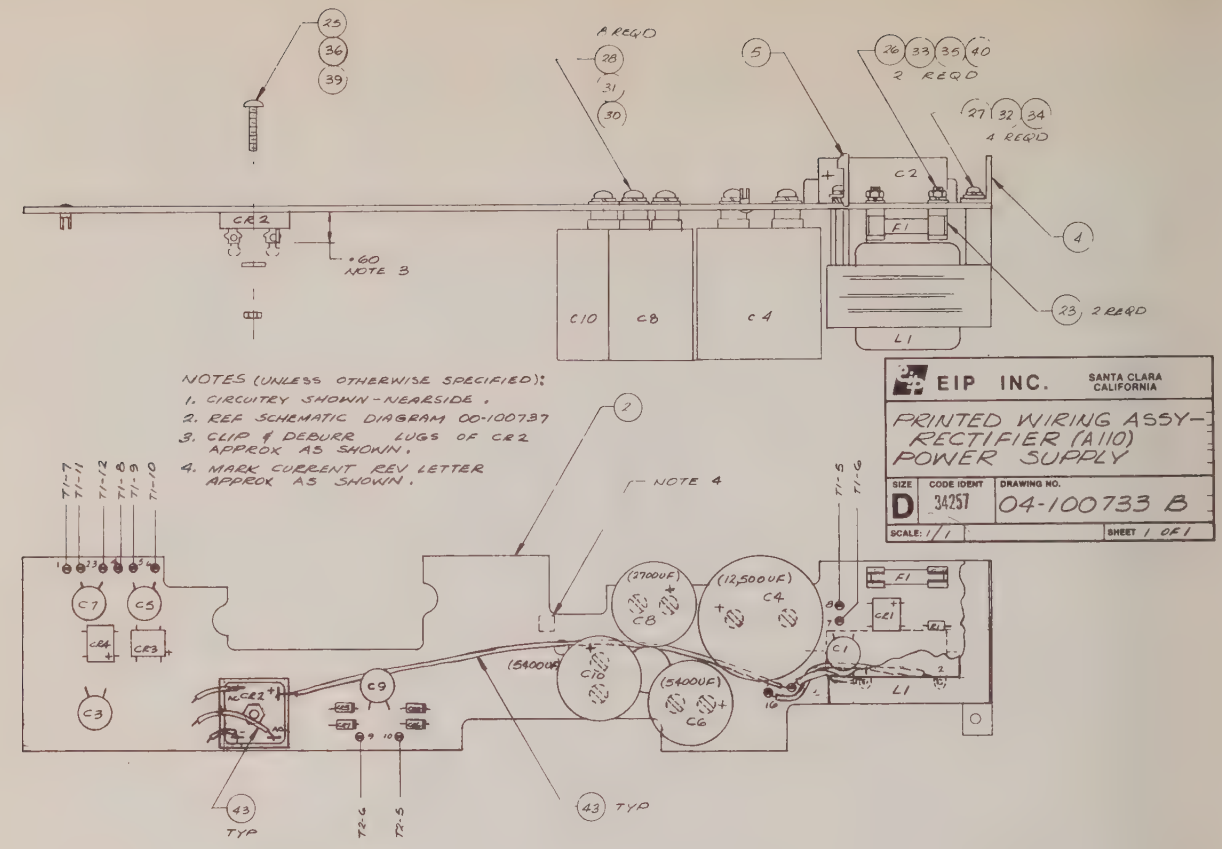

REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVED
A | REVISED AND REDRAWN PER ECN 7023 | 12/18/69
B | REVISED PER ECN 7043 & 7053 | 2/15/70
C | R27 WAS 2.7K, R30 WAS 100R, ECN 7096 | 11/4/70
DET
8.2UH
1 UF ±10% 35V
3.3 UF ±10% 15V
FL2
FL1
+12V DC
RFC 4 100450-01
RFC 1 100450-01
RFC 2 100450-01
RFC 3 100450-01
L2 FERRITE BEAD
L1 100636-01
L3 FERRITE BEAD
FERRITE BEAD
INPUT J2
OUTPUT J1
Q1 SE3005
Q2 SE3005
Q3 SE3005
Q4 SE3005
Q5 2N4258
Q6 SE3005
Q7 2N4258
Q8 SE3005
Q9 2N4258
Q10 SE3005
IC 1 CA3049
C1 .01 ±20% 100V
C2 3.3 ±10% 15V
C3
C4 820PF ±5% 500V
C5
C6 820PF ±5% 500V
C7 .33 ±10% 15V
C8
C9 .01 ±20% 100V
C10 .1 ±10% 250V
C11 3.3 ±10% 15V
C12
C13 .01 ±20% 100V
C14 .33 ±10% 15V
C15 .01 ±20% 100V
C16 820PF ±5% 500V
C17
C18 .01 ±20% 100V
C19 3.3 ±10% 15V
C20 .01 ±20% 100V
R1 1.2K
R2 2.2K
R3 390
R4 51
R5 1.2K
R6 2.2K
R7 390
R8 51
R9 2.7K
R10 9.1K
R11 270
R12 100
R13 270
R14 51
R15 2.7K
R16 9.1K
R17 270
R18 100
R19 270
R20 51
R21 2.2K
R22 1K
R23 51
R24 2.2K
R25 1.5K
R26 910
R27 1.6K
R28 9.1K
R29 270
R30 51
R31 270
R32 5.6
R33 220
R34 5.6
NOTES (UNLESS OTHERWISE SPECIFIED):
1. ALL RESISTANCE IN OHMS, ±5%, 1/4W
ALL CAPACITANCE IN MICRO FARADS
2 COMPONENTS OUTSIDE DOTTED LINE MOUNTED ON ASSY #100407
3 VALUE SELECTED AT TEST
LIST OF MATERIALS
QTY. REQD.
ITEM NO | PART OR IDENTIFYING NO | NOMENCLATURE/DESCRIPTION | CODE IDENT | MATERIAL/SPECIFICATIONS
MODEL 363A MODEL 362A
MODEL 351A MODEL 350A
100369 | NEXT ASSY | USED ON
DASH NO. | APPLICATION
DO NOT SCALE DRAWING
PREPARED M.J. KOOREN 8/28/69
CHECKED
APPROVED E.G. JOHNSON 9/15/69
CUSTOMER APPROVAL
GOVT APPROVAL
EIP LABS SANTA CLARA CALIFORNIA
SCHEMATIC DIAGRAM- HI-GAIN VIDEO AMPLIFIER (ASSY 104)
SIZE D | CODE IDENT | DRAWING NO 100366 C
SCALE — | SHEET 1 OF 1
100366 C

FIGURE 9-21

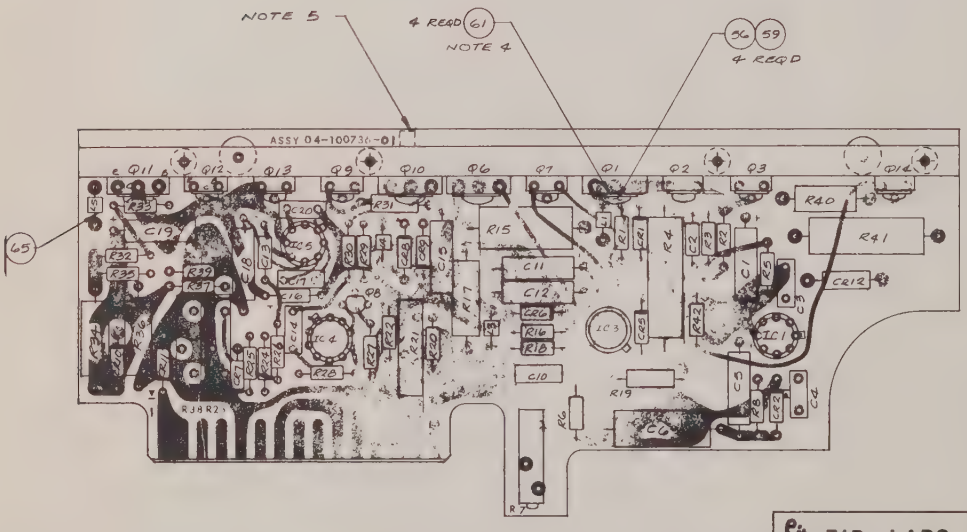


EIP INC. SANTA CLARA CALIFORNIA

PRINTED WIRING ASSY—RECTIFIER (A110) POWER SUPPLY

SIZE	CODE IDENT	DRAWING NO.
D	34257	04-100733 B

SCALE: 1/1 SHEET 1 OF 1



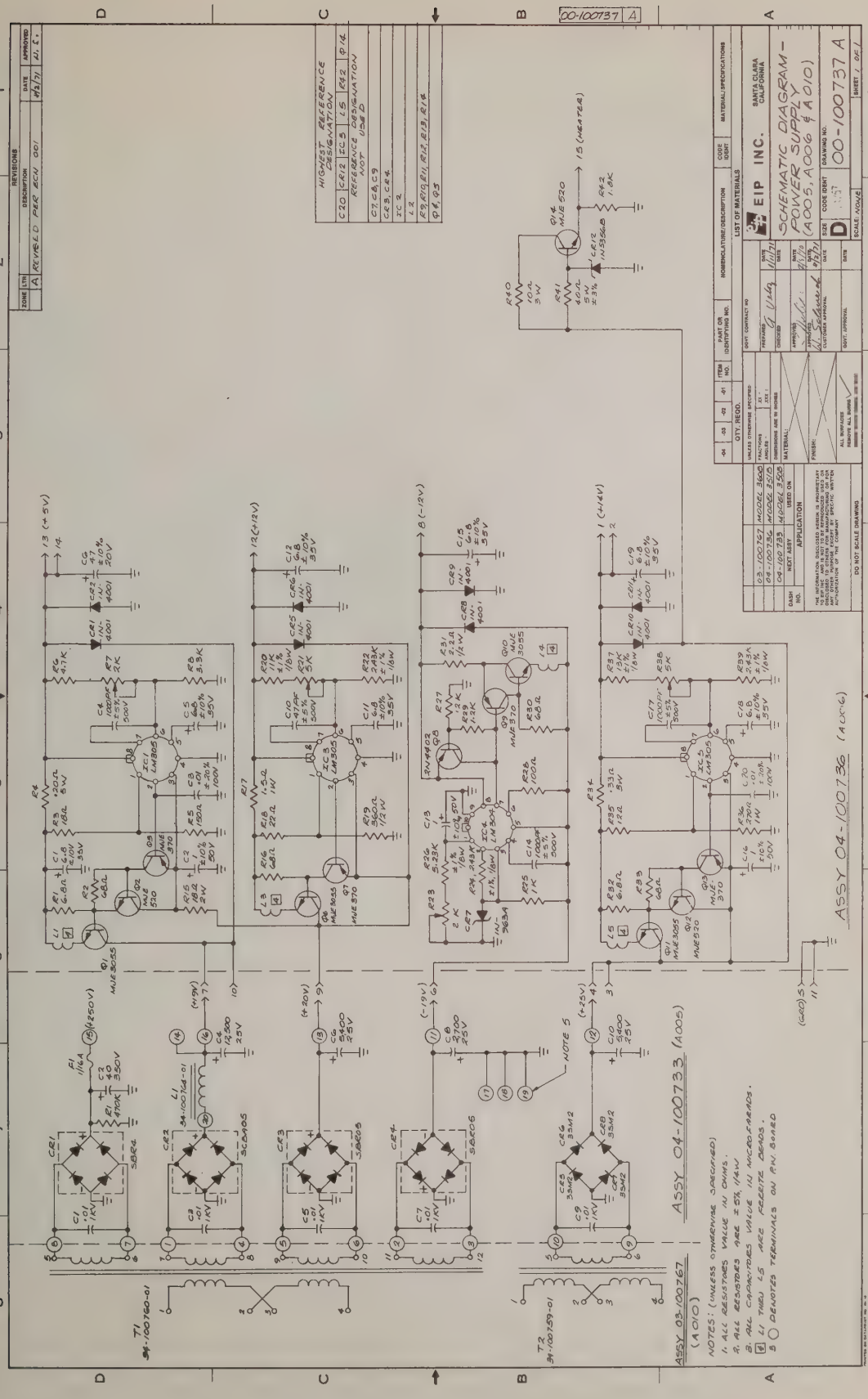
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. COMPONENTS SIDE SHOWN.
2. CIRCUITRY SHOWN - COMPONENT SIDE.
3. REF SCHEMATIC DIAGRAM 00-100737.
4. COAT BOTH SIDES OF ITEMS 60 & 61 (MICA WASHERS) WITH ITEM 63 (THERMAL COMPOUND). TRIM WASHERS TO SUIT.
5. MARK CURRENT REV LETTER APPROX AS SHOWN.

EIP LABS SANTA CLARA CALIFORNIA

PRINTED WIRING ASSY—REGULATOR POWER SUPPLY (A006)

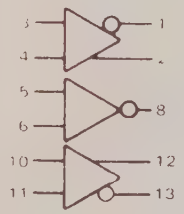
SIZE	CODE IDENT	DRAWING NO.
C	34257	04-100736 B

SCALE: 2/1 SHEET 1 OF 1


00-100737 A
SCHEMATIC DIAGRAM - POWER SUPPLY (A005, A006 & A010)
EIP INC.
SANTA CLARA CALIFORNIA
00-100737 A
ASSY 04-100736 (A0X6)
ASSY 03-100733 (A005)
ASSY 03-100767 (A010)
T1 34-100760-01
T2 34-100759-01
L1 34-100764-01
NOTE 5

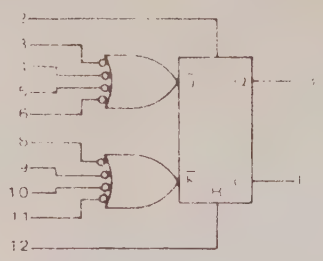
IC TYPE	DIAGRAM NO.
CA3049	23
DM937N	18
DM7400N	17
DM7402N	9
DM7404N	18
DM7405N	18
DM7410N	10
DM7420N	11
DM7430N	12
DM7441N	13
DM7442N	22
DM7473N	25
DM7474N	26
DM7475N	19
DM7495N	24
DM8280N	5
DM8601N	20
LM304	15
LM305	14
LM710CN	16
LM711CN	21
LM741CN	6
MC1013P	3
MC1034P	8
MC1035P	1
MC1660L	4
MC1670L	7
SN7408N	2

1

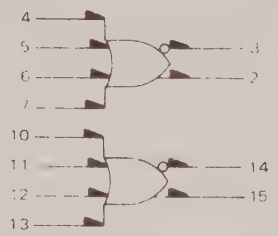


2

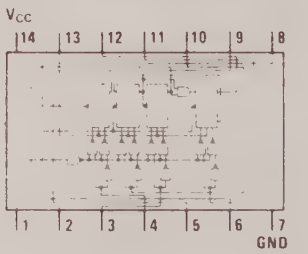
3



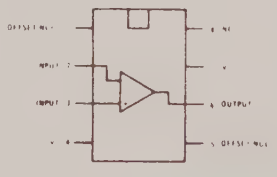
4



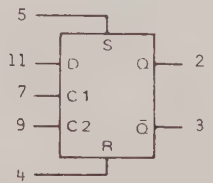
5



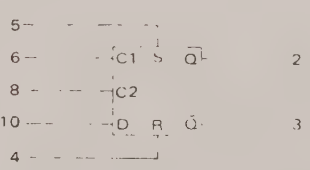
6



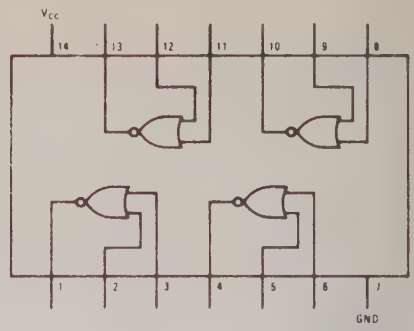
7



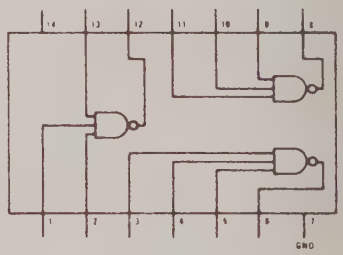
8



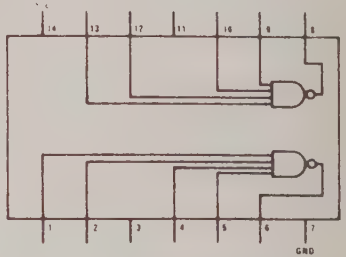
9



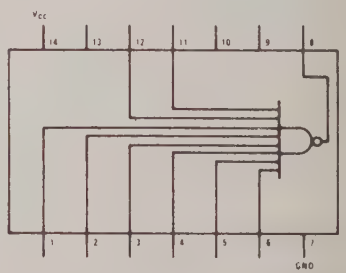
10



11



12



13

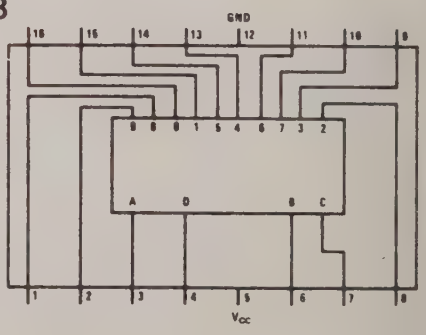
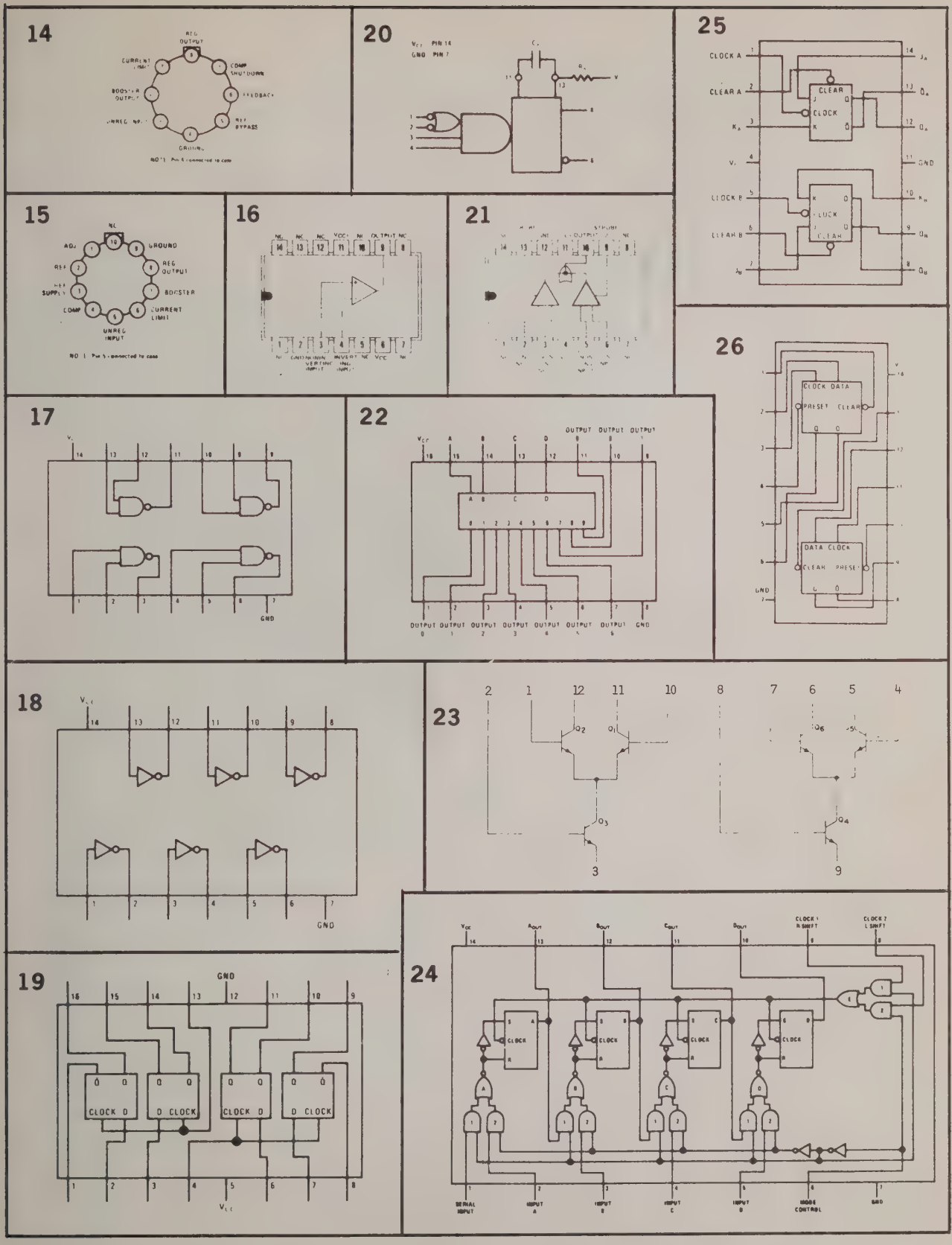


FIGURE 9-24 IC CONNECTION DIAGRAMS


14
15
16
17
18
19
20
21
22
23
24
25
26
GROUND
REG OUTPUT
BOOSTER
CURRENT LIMIT
UNREG INPUT
COMP
GND
CLOCK A
CLEAR A
CLOCK B
CLEAR B
CLOCK D
D CLOCK
OUTPUT OUTPUT OUTPUT
OUTPUT OUTPUT OUTPUT OUTPUT OUTPUT OUTPUT GND
CLOCK DATA
PRESET CLEAR
DATA CLOCK
CLEAR PRESET

APPENDIX A

OPTIONS 03 AND 05 (TIME BASE)

A-1 GENERAL

A-2. Two higher stability options are available. Option 03 provides a maximum daily aging rate of 1×10^{-9}, while Option 05 has a maximum daily aging rate of 5×10^{-10}. Both options involve replacement of the standard time base with a higher stability unit containing a glass enclosed third overtone crystal but with the same external mechanical configuration.

A-3 SPECIFICATIONS

Refer to Table A-1 for specifications on Options 03 and 05.

TABLE A-1
SPECIFICATIONS
TIME BASE OPTIONS

OPTION 03: High Stability Time Base.
- **Crystal Frequency:** 5 MHz.
- **Stability:**
  - **Aging Rate:** <1 part in 10^9 per 24 hours after 72 hours warmup.
  - **Short Term:** <1 part in 10^{10} rms (1 second averaging).
  - **Temperature:** <3 parts in 10^8 maximum shift (10 to 55°C).
  - **Line Voltage:** ±10% change in line voltage produces frequency shift of $< \pm 2$ parts in 10^{10}.
- **Oven Control:** Proportional (activated whenever unit is plugged into AC power source).

OPTION 05: Ultra High Stability Time Base.
- **Crystal Frequency:** 5 MHz.
- **Stability:**
  - **Aging Rate:** <5 parts in 10^{10} per 24 hours after 72 hours warmup.
  - **Short Term:** <1 part in 10^{10} rms (1 second averaging).
  - **Temperature:** <3 parts in 10^8 maximum shift (10 to 55°C).
  - **Line Voltage:** ±10% change in line voltage produces frequency shift of $< \pm 2$ parts in 10^{10}.
- **Oven Control:** Proportional (activated whenever unit is plugged into AC power source).

A-4 PART NUMBERS, OPTIONS 03 AND 05

Option 03, High Stability Time Base, Part No. 100671-02.

Option 05, Ultra-High Stability Time Base, Part No. 100671-03.

APPENDIX B

OPTION 04 (BCD DIGITAL OUTPUT)

B-1 GENERAL

B-2. The BCD option consists of the addition of BCD Assembly A008. This provides an 8-4-2-1 "1" state positive code for the ten most significant data digits. This output is suitable for system use or for use with digital data recorders (HP 5050B or equivalent). Refer to Table B-2 for connector wiring.

B-3 SPECIFICATIONS

Refer to Table B-1 for specifications on Option 04.

TABLE B-1
SPECIFICATIONS
DIGITAL OUTPUT - OPTION 04

OPTION 04: Digital Output.
BCD Code: 8421 "1" state positive.
Format: 10 most significant data digits in parallel form.
"0" State Level: 0 to 0.4V, 5 mA current sink capability.
"1" State Level: +5V, 2 kohm source impedance.
Negative Reference: Ground.
Positive Reference: +5V, 22 ohm source impedance.
Print Command: +5V to 0V step, fall time < 1 microsec, 20 microsec. width, 2 kohm source impedance.
Hold Off Requirements:
Maximum: 50 volts.
Minimum: 2 volts.
Output Connector: Amphenol 57-40500 50-pin female. Mating connector, Amphenol 57-30500 50-pin, male.

B-4 THEORY OF OPERATION

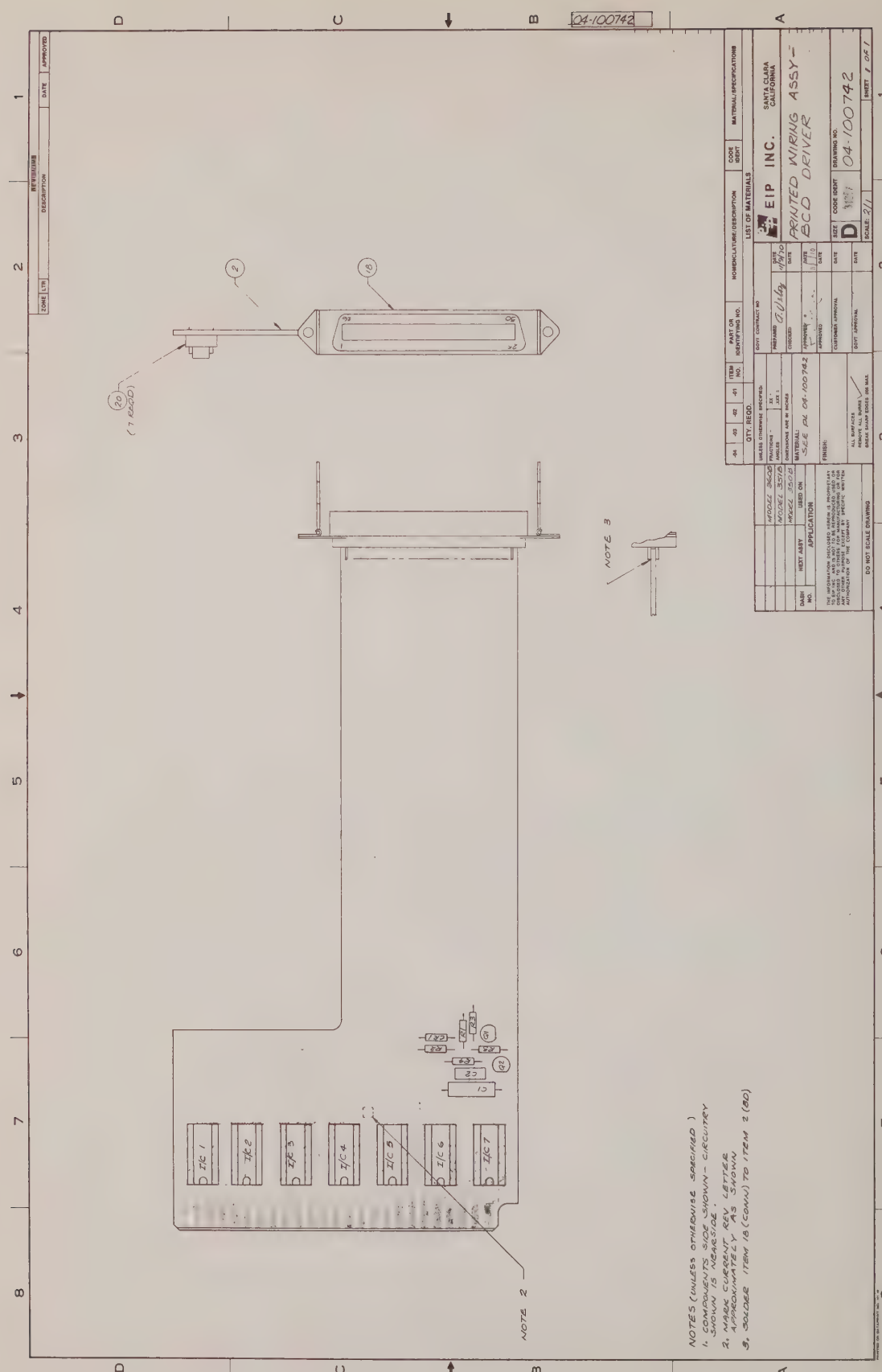
B-5. The BCD outputs of the memory units on the Display Board (A003) are inverted in A008IC1 through IC7 to provide a positive logic, T^2L compatible output. (See Figures B-1 and B-2.) A print command generated by the Control Logic Board (A002) is inverted to provide a 20 microsecond negative logic (+5 V to 0 V) pulse. Transistors A008Q1 and Q2, generate a MEMORY LOAD INHIBIT command upon application of a positive level from 2.5 to 30 volts at pin 22. This command inhibits the transfer of new data into the memory.

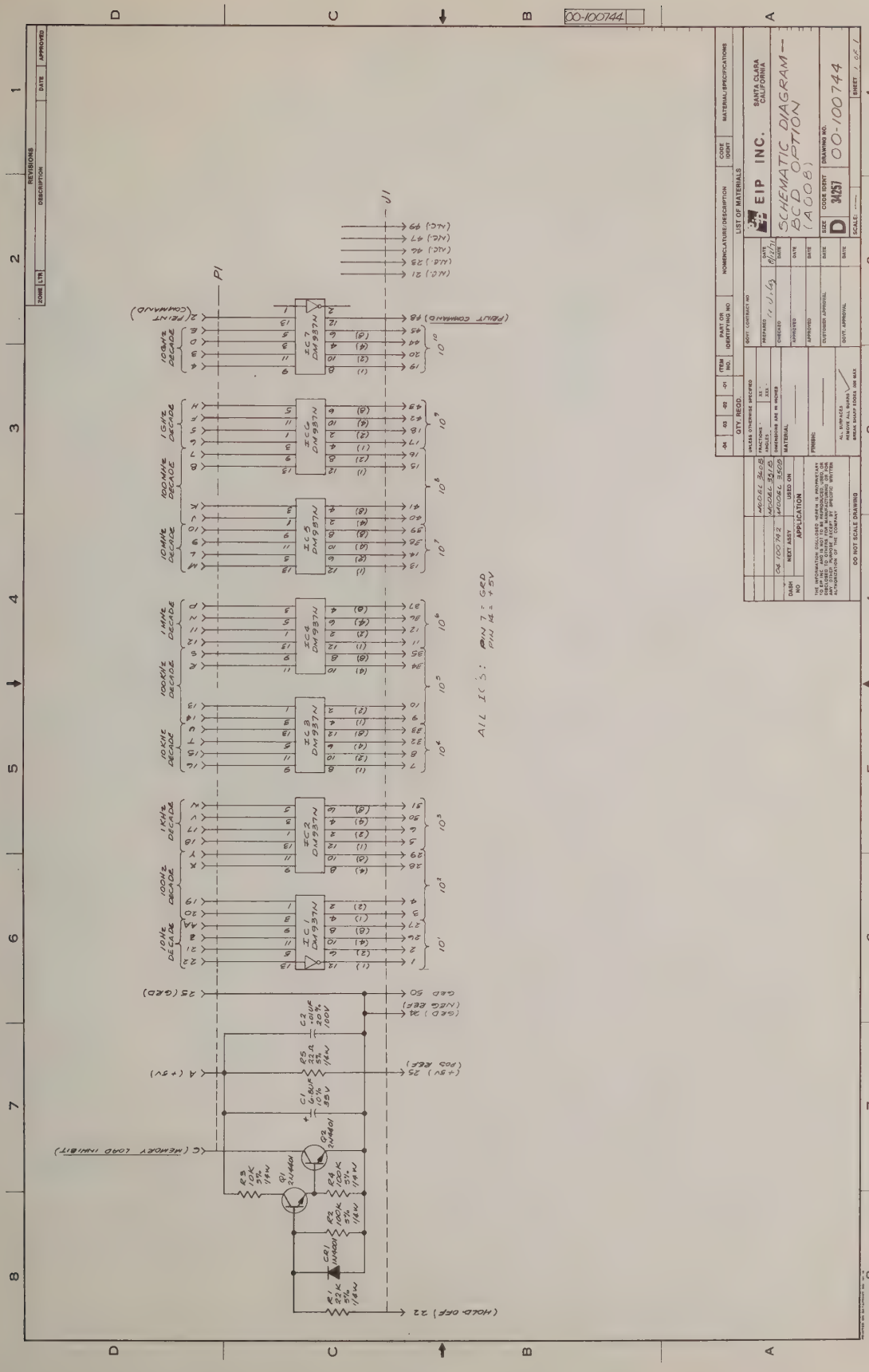
TABLE B-2.
OPTION 04, CONNECTOR WIRING

Pin No.	Function	Pin No.	Function
1	10^1 1-bit	26	10^1 4-bit
2	10^1 2-bit	27	10^1 8-bit
3	10^2 1-bit	28	10^2 4-bit
4	10^2 2-bit	29	10^2 8-bit
5	10^3 1-bit	30	10^3 4-bit
6	10^3 2-bit	31	10^3 8-bit
7	10^4 1-bit	32	10^4 4-bit
8	10^4 2-bit	33	10^4 8-bit
9	10^5 1-bit	34	10^5 4-bit
10	10^5 2-bit	35	10^5 8-bit
11	10^6 1-bit	36	10^6 4-bit
12	10^6 2-bit	37	10^6 8-bit
13	10^7 1-bit	38	10^7 4-bit
14	10^7 2-bit	39	10^7 8-bit
15	10^8 1-bit	40	10^8 4-bit
16	10^8 2-bit	41	10^8 8-bit
17	10^9 1-bit	42	10^9 4-bit
18	10^9 2-bit	43	10^9 8-bit
19	10^{10} 1-bit	44	10^{10} 4-bit
20	10^{10} 2-bit	45	10^{10} 8-bit
21	NC	46	NC
22	Inhibit	47	NC
23	NC	48	Print Command
24	-Ref.	49	NC
25	+Ref.	50	Ground

NOTE: The 10^1 bit is the least significant digit and corresponds to the 10-Hz output. There is no output for the 10^0 bit.

REFERENCE DESIGNATION	DESCRIPTION/ /NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A008	PC ASSY:BCD ASSEMBLY,OPTION 04	04-100742-01	EIP	1
A008C1	C:FXD ELECT TA 6.8UF	CS13BF685K	81349	1
A008C2	C:FXD CER .01UF	TCS-10	81349	1
A008CR1	DIODE:SI RECTIFIER	1N4001	04713	1
A008IC1	INTEG CKT:HEX INVERTER	DM937N	27014	7
A008IC2	INTEG CKT:HEX INVERTER	DM937N	27014	7
A008IC3	INTEG CKT:HEX INVERTER	DM937N	27014	7
A008IC4	INTEG CKT:HEX INVERTER	DM937N	27014	7
A008IC5	INTEG CKT:HEX INVERTER	DM937N	27014	7
A008IC6	INTEG CKT:HEX INVERTER	DM937N	27014	7
A008IC7	INTEG CKT:HEX INVERTER	DM937N	27014	7
A008J1	CONNECTOR:50 PIN	57-40500	02660	1
A008Q1	TRANSISTOR:NPN	2N4401	04713	2
A008Q2	TRANSISTOR:NPN	2N4401	04713	2
A008R1	R:FXD COMP 22K OHM	RC07GF223J	81349	1
A008R2	R:FXD COMP 100K OHM	RC07GF104J	81349	2
A008R3	R:FXD COMP 10K OHM	RC07GF103J	81349	1
A008R4	R:FXD COMP 100K OHM	RC07GF104J	81349	2
A008R5	R:FXD COMP 22 OHM	RC07GF220J	81349	1
A008MP5	COVER:50 PIN CONNECTOR	DELETED	EIP	1


04-100742
EIP INC.
SANTA CLARA CALIFORNIA
PRINTED WIRING ASSY - BCD DRIVER
04-100742
NOTES (UNLESS OTHERWISE SPECIFIED)
1. COMPONENTS SIDE SHOWN - CIRCUITRY SHOWN IS NEARSIDE.
2. MARK CURRENT REV LETTER APPROXIMATELY AS SHOWN
3. SOLDER ITEM 18 (CONN) TO ITEM 2 (PC)
NOTE 2
NOTE 3
IC 1
IC 2
IC 3
IC 4
IC 5
IC 6
IC 7


00-100744
EIP INC.
SANTA CLARA CALIFORNIA
SCHEMATIC DIAGRAM — BCD OPTION (1A008)
00-100744
SIZE D
CODE IDENT 34251
SHEET 1 OF 1
DO NOT SCALE DRAWING
MATERIAL
APPLICATION
NEXT ASSY
DASH NO
04 100742
MODEL 350B
MODEL 351B
MODEL 350B
ALL ICS: PIN 7 = GRD PIN 14 = +5V
P1
J1
IC1 DM8314N
IC2 DM8314N
IC3 DM8314N
IC4 DM8314N
IC5 DM8314N
IC6 DM8314N
IC7 DM8314N
1MHz DECADE
100KHz DECADE
10KHz DECADE
1KHz DECADE
100Hz DECADE
10Hz DECADE
1Hz DECADE
(PRINT COMMAND)
(HOLD OFF) 22
(MEMORY LOAD INHIBIT)
(+5V) 25
(GRD) 23
(GRD) 24
(GRD) 50
(NOT USED) 99
(NOT USED) 47
(NOT USED) 46
(NOT USED) 23
(NOT USED) 21
Q1 2N4401
Q2 2N4401
CR1 1N4001
R1 22K 5% 1/8W
R2 100K 5% 1/8W
R3 10K 5% 1/8W
R4 100K 5% 1/8W
R5 33Ω 5% 1/4W
C1 6.8μF 10V 85V
C2 .01μF 10K 100V

APPENDIX C
OPTION 06 (PROGRAMMABLE IF OFFSETS)

C-1 GENERAL

C-2. Option 06 allows the reading of any frequency within the range of the counter to be increased or decreased by any of eight selectable offsets except that negative offsets are not available below 210 MHz. If no offsets are selected, the counter reads normally. Offsets are selected by ground contact closure at a rear panel programming connector. A 4-line binary code selects the desired IF offset. On counters equipped with Option 06, Display Board A003 is replaced by Display Board A009 and a rear panel connector is provided for programming.

C-3 SPECIFICATIONS

Refer to Table C-1 for specifications on Option 06.

TABLE C-1
SPECIFICATIONS
PROGRAMMABLE IF
OFFSET - OPTION 06

OPTION 06: Programmable IF Offsets.

Mode of Operation:	The readings of any frequency within the range of the counter are increased or decreased by the selected IF offset except no negative offsets are available for input frequencies below 210 MHz. If no offsets are selected, counter reads normally.
Offset Frequencies:	+ 21.4 MHz, — 21.4 MHz, + 30 MHz, — 30 MHz, + 60 MHz, — 60 MHz, + 160 MHz, — 160 MHz.
Offset Selection:	Ground contact closure (T^2L and DTL compatible) at rear panel programming connector in 4 line binary code selects desired IF offset.
Programming Connector:	Amphenol 57-40240 24 pin, female. Mating Connector Amphenol 57-30240 24 pin, male.
Accessory Available:	EIP Model 1001A Remote Programmer provides proper ground contact closure programming to select desired IF offset. Includes 6 ft. interconnecting cable.

C-4 PROGRAMMING INSTRUCTIONS

C-5. Table C-2 indicates the ground contact closures required to program any one of the eight IF offsets available. If no offset is programmed, the counter will read normally.

C-6 THEORY OF OPERATION

C-7. Since only positive offsets are allowed in Band I, the preset (or added) numbers correspond exactly to the desired offset (See Table C-3). In Bands II and III, where negative offsets are possible, the sweep circuits in the Converter Control Board (A101) have been calibrated so that the 3MSD digits are 200 MHz low. In order to provide the desired offset in these bands, the offset circuitry then must add an offset which is 200 MHz greater than the desired offset (see Table C-3). For normal counter operation the offset circuitry adds a constant 200 MHz to the counter reading to compensate for the calibration of Converter Control Board sweep circuits.

C-8. Offset programming is accomplished by presetting the 100 KHz, 1 MHz, and 10 MHz digits, and by serially incrementing the 100 MHz digit. Serial addition for the 100 MHz digit is required because this digit has previously been preset with the harmonic number of the YIG-tuned Comb Generator by the Converter Control Board (A101).

C-9. Ground contact closures on the appropriate lines are converted to a decimal output by the BCD-to-Decimal Converter (A009IC42); (see Figure C-1 and C-2). The decimal outputs drive gates which supply the proper presets to the 100 KHz, 1 MHz and 10 MHz digits. These numbers are preset into the count chain upon application of the COUNTER PRESET pulse at pin 13 (refer to Figure 4-3). The 100 MHz serial addition is performed by presetting a shift register (A009IC49). Pulses from the offset clock output are then counted by the 100 MHz digit counter (A009IC31), and simultaneously fed to the shift register. When the shift register has been incremented to its preset number, the "D" output (A009IC49, pin 10) goes high, inhibiting the clock pulses, and stopping the serial addition in the 100 MHz digit counter.

C-10 PARTS LIST, OPTION 06

C-11. The parts list in Table C-4, lists only the additional parts contained on Display Board A009, which are not contained on Display Board A003. For a list of the parts contained on Display Board A003, see Table 8-1.

	(J7) PIN NUMBER				
	1	2	3	4	24
No Offset	0	0	0	0	Ground
+ 21.4 MHz	1	0	0	0	Ground
- 21.4 MHz	0	1	0	0	Ground
+ 30.0 MHz	1	1	0	0	Ground
- 30.0 MHz	0	0	1	0	Ground
+ 60.0 MHz	1	0	1	0	Ground
- 60.0 MHz	0	1	1	0	Ground
+160.0 MHz	1	1	1	0	Ground
-160.0 MHz	0	0	0	1	Ground

NOTES: "1" = Contacts closed (V_{pin} to ground $\leqslant 0.4$ V)

"0" $\stackrel{=}{=}$ Contacts open (V_{pin} to ground $\geqslant 2.4$ V)

TABLE C-2.
OPTION 06, IF OFFSET PROGRAMMING

Input Bits				Indicated IF OFFSET	Preset Digits (Band I)			Serial Addition (Band 1) 100 MHz	Preset Digits (Bands II and III)			Serial Addition (Band II & III) 100 MHz
1	2	3	4		100 KHz	1 MHz	10 MHz		100 KHz	1 MHz	10 MHz	
1	1	1	1	0	0	0	0	0	0	0	0	2
0	1	1	1	+ 21.4 MHz	4	1	2	0	4	1	2	2
1	0	1	1	- 21.4 MHz	X	X	X	0	6	8	7	1
0	0	1	1	+ 30.0 MHz	0	0	3	0	0	0	3	2
1	1	0	1	- 30.0 MHz	X	X	X	0	0	0	7	1
0	1	0	1	+ 60.0 MHz	0	0	6	0	0	0	6	2
1	0	0	1	- 60.0 MHz	X	X	X	0	0	0	4	1
0	0	0	1	+160.0 MHz	0	0	6	1	0	0	6	3
1	1	1	0	-160.0 MHz	X	X	X	0	0	0	4	0

X = Offset Not Available

TABLE C-3.
OPTION 06, IF OFFSET PRESETS

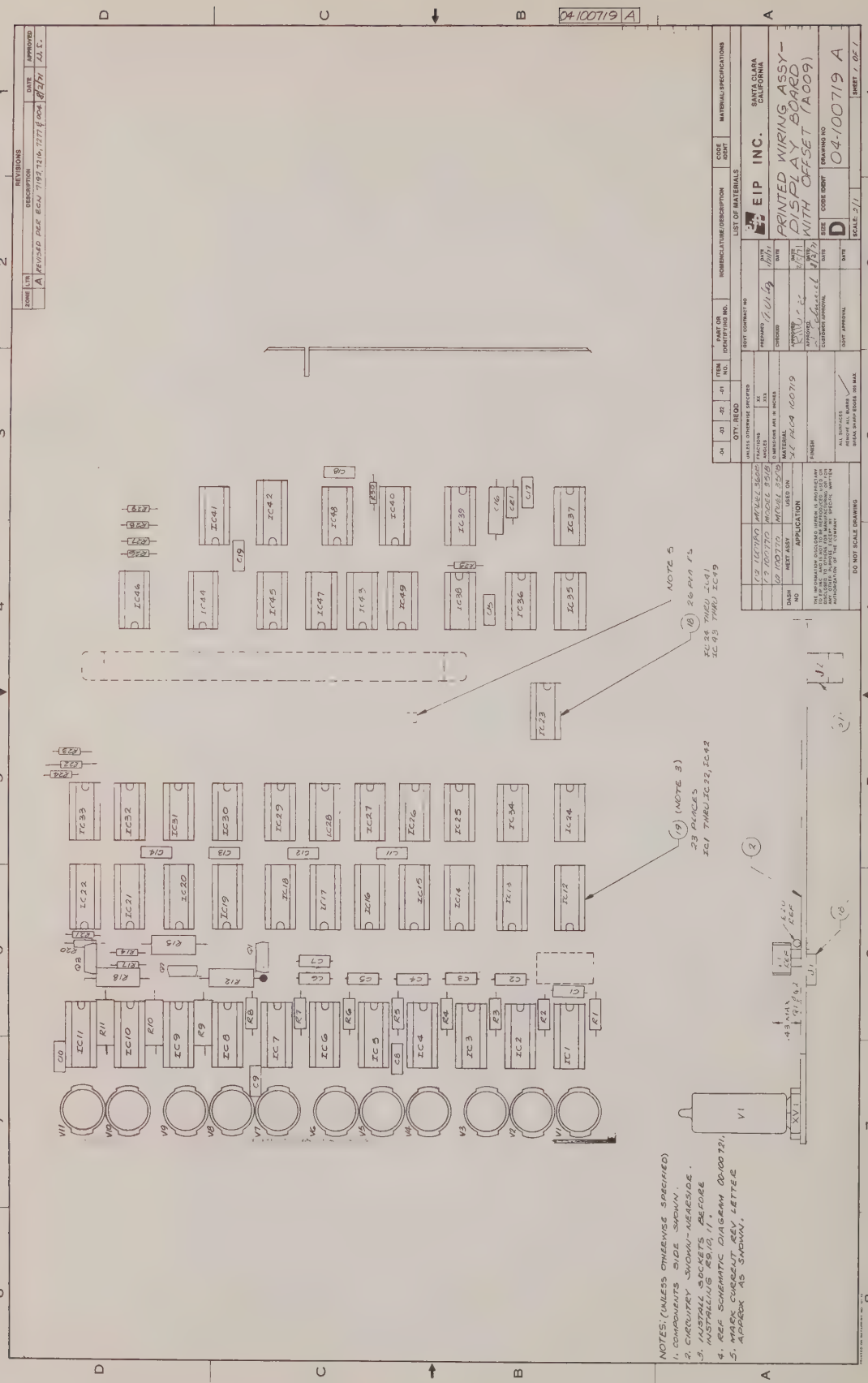
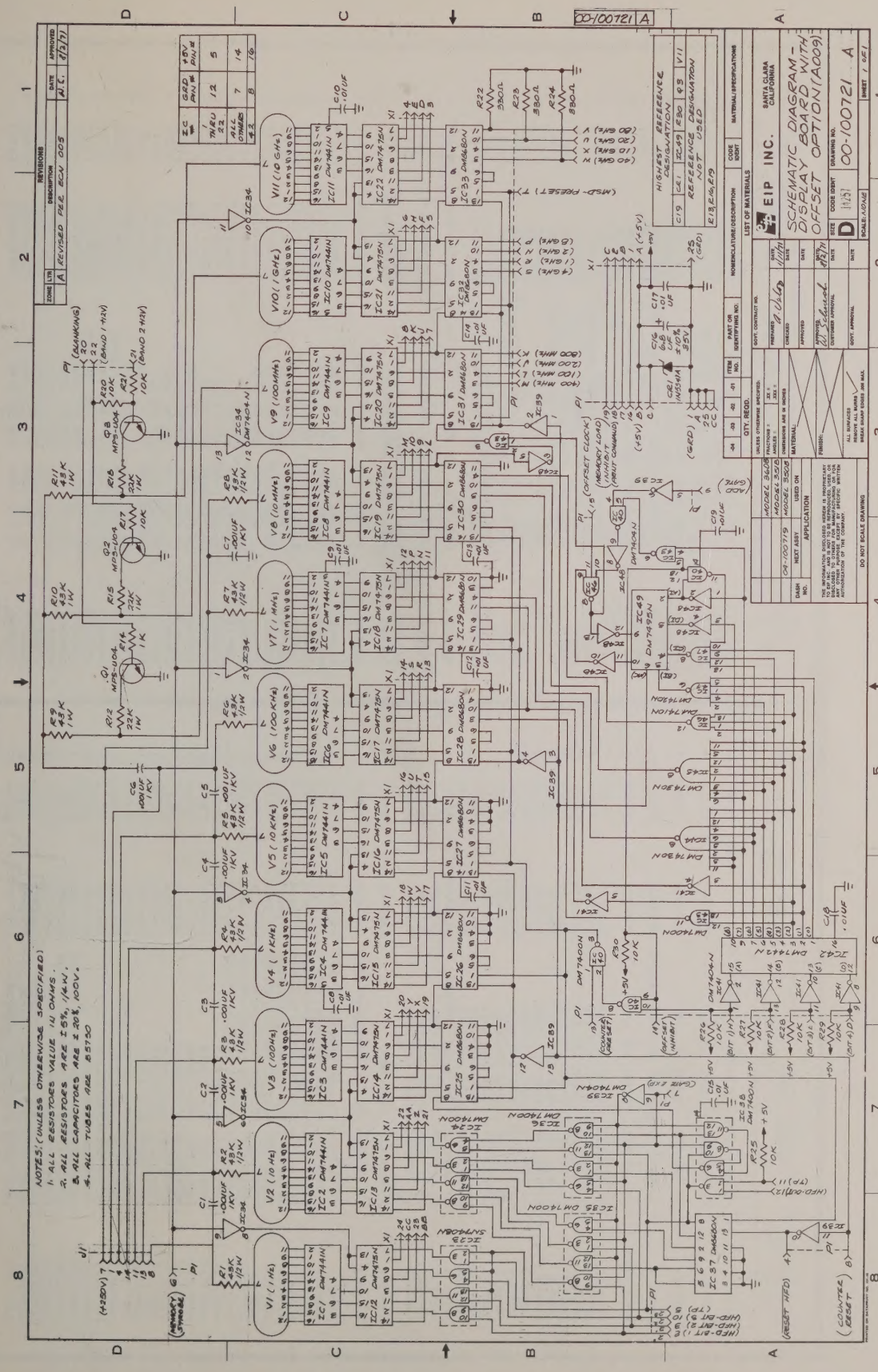

04-100719 A
EIP INC.
SANTA CLARA CALIFORNIA
PRINTED WIRING ASSY-DISPLAY BOARD WITH OFFSET (A009)
04-100719 A
SCALE: 2/1
SHEET 1 OF 1
DO NOT SCALE DRAWING
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. COMPONENTS SIDE SHOWN.
2. CIRCUITRY SHOWN-NEARSIDE.
3. INSTALL SOCKETS BEFORE INSTALLING IC9,11.
4. REF SCHEMATIC DIAGRAM 04-100721.
5. MARK CURRENT REV LETTER AS SHOWN.

FIGURE C-1


NOTES: (UNLESS OTHERWISE SPECIFIED)
1. ALL RESISTORS VALUE IN OHMS.
2. ALL RESISTORS ARE ±5%, 1/4W.
3. ALL CAPACITORS ARE ±20%, 100V.
4. ALL TUBES ARE 5730
SCHEMATIC DIAGRAM - DISPLAY BOARD WITH OFFSET OPTION (A009)
EIP INC.
SANTA CLARA CALIFORNIA
00-100721 A
DO NOT SCALE DRAWING

REFERENCE DESIGNATION	DESCRIPTION/ /NOMENCLATURE	MANUFACTURER PART NUMBER	MFR	AQ
A009	PC-ASSY DISPLAY W/OFFSET OPTION 06	04-100719-01	EIP	1
A009C1	C: FXD CER .001UF 20% 1KV	5GA-D10	56289	7
A009C2	C: FXD CER .001UF 20% 1KV	5GA-D10	56289	7
A009IC2	INTEG CKT: BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A009C3	C: FXD CER .001UF 20% 1KV	5GA-D10	56289	7
A009C4	C: FXD CER .001UF 20% 1KV	5GA-D10	56289	7
A009C5	C: FXD CER .001UF 20% 1KV	5GA-D10	56289	7
A009C6	C: FXD CER .001UF 20% 1KV	5GA-D10	56289	7
A009C7	C: FXD CER .001UF 20% 1KV	5GA-D10	56289	7
A009C8	C: FXD CER .01UF 20% 100V	TG-S10	56289	11
A009C9	C: FXD CER .01UF 20% 100V	TG-S10	56289	11
A009C10	C: FXD CER .01UF 20% 100V	TG-S10	56289	11
A009C11	C: FXD CER .01UF 20% 100V	TG-S10	56289	11
A009C12	C: FXD CER .01UF 20% 100V	TG-S10	56289	11
A009C13	C: FXD CER .01UF 20% 100V	TG-S10	56289	11
A009C14	C: FXD CER .01UF 20% 100V	TG-S10	56289	11
A009C15	C: FXD CER .01UF 20% 100V	TG-S10	56289	11
A009C16	C: FXD ELECT TA 6.8UF 10% 35V	CS13BF685K	81349	1
A009C17	C: FXD CER .01UF 20% 100V	TG-S10	56289	11
A009C18	C: FXD CER .01UF 20% 100V	TG-S10	56289	11
A009C19	C: FXD CER .01UF 20% 100V	TG-S10	56289	11
A009CR1	DIODE: SI 6.2V 5W	1N5341A	04713	1
A009IC1	INTEG CKT: BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A009IC3	INTEG CKT: BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A009IC4	INTEG CKT: BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A009IC5	INTEG CKT: BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A009IC6	INTEG CKT: BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A009IC7	INTEG CKT: BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A009IC8	INTEG CKT: BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A009IC9	INTEG CKT: BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A009IC10	INTEG CKT: BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A009IC11	INTEG CKT: BCD/DEC DECODER/DRIVER	DM7441N	27014	11
A009IC12	INTEG CKT: QUAD LATCH	DM7475N	27014	11
A009IC13	INTEG CKT: QUAD LATCH	DM7475N	27014	11
A009IC14	INTEG CKT: QUAD LATCH	DM7475N	27014	11
A009IC15	INTEG CKT: QUAD LATCH	DM7475N	27014	11
A009IC16	INTEG CKT: QUAD LATCH	DM7475N	27014	11
A009IC17	INTEG CKT: QUAD LATCH	DM7475N	27014	11
A009IC18	INTEG CKT: QUAD LATCH	DM7475N	27014	11
A009IC19	INTEG CKT: QUAD LATCH	DM7475N	27014	11
A009IC20	INTEG CKT: QUAD LATCH	DM7475N	27014	11
A009IC21	INTEG CKT: QUAD LATCH	DM7475N	27014	11
A009IC22	INTEG CKT: QUAD LATCH	DM7475N	27014	11
A009IC23	INTEG CKT: QUAD 2-INPUT NAND GATE	SN7408N	01295	1
A009IC24	INTEG CKT: QUAD 2-INPUT NAND GATE	DM7400N	27014	6
A009IC25	INTEG CKT: BCD DECADE COUNTER	DM8280N	27014	10
A009IC26	INTEG CKT: BCD DECADE COUNTER	DM8280N	27014	10
A009IC27	INTEG CKT: BCD DECADE COUNTER	DM8280N	27014	10
A009IC28	INTEG CKT: BCD DECADE COUNTER	DM8280N	27014	10
A009IC29	INTEG CKT: BCD DECADE COUNTER	DM8280N	27014	10
A009IC30	INTEG CKT: BCD DECADE COUNTER	DM8280N	27014	10
A009IC31	INTEG CKT: BCD DECADE COUNTER	DM8280N	27014	10
A009IC32	INTEG CKT: BCD DECADE COUNTER	DM8280N	27014	10
A009IC33	INTEG CKT: BCD DECADE COUNTER	DM8280N	27014	10
A009IC34	INTEG CKT: HEX INVERTER	DM7404N	27014	4
A009IC35	INTEG CKT: QUAD 2-INPUT NAND GATE	DM7400N	27014	6
A009IC36	INTEG CKT: QUAD 2-INPUT NAND GATE	DM7400N	27014	6
A009IC37	INTEG CKT: BCD DECADE COUNTER	DM8280N	27014	10
A009IC38	INTEG CKT: QUAD 2-INPUT NAND GATE	DM7400N	27014	6
A009IC39	INTEG CKT: HEX INVERTER	DM7404N	27014	4
A009IC40	INTEG CKT: QUAD 2-INPUT NAND GATE	DM7400N	27014	6
A009IC41	INTEG CKT: HEX INVERTER	DM7404N	27014	4
A009IC42	INTEG CKT: BCD TO DEC. DECODER	DM7442N	27014	1
A009IC43	INTEG CKT: QUAD 2-INPUT NAND GATE	DM7400N	27014	6
A009IC44	INTEG CKT: 8-INPUT GATE	DM7430N	27014	2
A009IC45	INTEG CKT: 8-INPUT GATE	DM7430N	27014	2
A009IC46	INTEG CKT: TRPL 3-INPUT NAND GATE	DM7410N	27014	1
A009IC47	INTEG CKT: DUAL 4-INPUT NAND GATE	DM7420N	27014	1
A009IC48	INTEG CKT: HEX INVERTER	DM7404N	27014	4
A009IC49	INTEG CKT: 4 BIT SHIFT REGISTER	DM7495N	27014	1
A009J1	CONNECTOR 50 PIN	50-50B-10	02660	1
A009Q1	TRANSISTOR: NPN MODIFIED	20-100894-01	EIP	3
A009Q2	TRANSISTOR: NPN MODIFIED	20-100894-01	EIP	3
A009Q3	TRANSISTOR: NPN MODIFIED	20-100894-01	EIP	3
A009R1	R: FXD COMP 43K 5% 1/2W	RC20GF433J	81349	8
A009R2	R: FXD COMP 43K 5% 1/2W	RC20GF433J	81349	8
A009R3	R: FXD COMP 43K 5% 1/2W	RC20GF433J	81349	8
A009R4	R: FXD COMP 43K 5% 1/2W	RC20GF433J	81349	8
A009R5	R: FXD COMP 43K 5% 1/2W	RC20GF433J	81349	8
A009R6	R: FXD COMP 43K 5% 1/2W	RC20GF433J	81349	8
A009R7	R: FXD COMP 43K 5% 1/2W	RC20GF433J	81349	8
A009R8	R: FXD COMP 43K 5% 1/2W	RC20GF433J	81349	8
A009R9	R: FXD COMP 43K 5% 1W	RC32GF433J	81349	3
A009R10	R: FXD COMP 43K 5% 1W	RC32GF433J	81349	3
A009R11	R: FXD COMP 43K 5% 1W	RC32GF433J	81349	3
A009R12	R: FXD COMP 22K 5% 1W	RC32GF223J	81349	3
A009R14	R: FXD COMP 1K 5% 1/4W	RC07GF102J	81349	1
A009R15	R: FXD COMP 22K 5% 1W	RC32GF223J	81349	3
A009R17	R: FXD COMP 10K 5% 1/4W	RC07GF103J	81349	9
A009R18	R: FXD COMP 22K 5% 1W	RC32GF223J	81349	3
A009R20	R: FXD COMP 10K 5% 1/4W	RC07GF103J	81349	9
A009R21	R: FXD COMP 10K 5% 1/4W	RC07GF103J	81349	9
A009R22	R: FXD COMP 330 OHM 5% 1/4W	RC07GF331J	81349	3
A009R23	R: FXD COMP 330 OHM 5% 1/4W	RC07GF331J	81349	3
A009R24	R: FXD COMP 330 OHM 5% 1/4W	RC07GF331J	81349	3
A009R25	R: FXD COMP 10K 5% 1/4W	RC07GF103J	81349	9
A009R26	R: FXD COMP 10K 5% 1/4W	RC07GF103J	81349	9
A009R27	R: FXD COMP 10K 5% 1/4W	RC07GF103J	81349	9
A009R28	R: FXD COMP 10K 5% 1/4W	RC07GF103J	81349	9
A009R29	R: FXD COMP 10K 5% 1/4W	RC07GF103J	81349	9
A009R30	R: FXD COMP 10K 5% 1/4W	RC07GF103J	81349	9

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